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University of the State of New York

NEW YORK STATE MUSEUM

FORTY-FOURTH ANNUAL REPORT

OF THE

REGENTS

FOR THE YEAR 1890

TRANSMITTED TO THE LEGISLATURE, JANUARY 30, 1891

ALBANY

JAMES B. LYON, STATE PRINTER

1892

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REGENTS

OF THE

UNIVERSITY OF THE STATE OF NEW YORK

[The Laws of 1889, ch. 529, made the State Library and State Museum departments of the University.]

GEORGE WILLIAM CURTIS, LL. D., *Chancellor*

ANSON J. UPSON, D. D., LL. D., *Vice-Chancellor*

DAVID B. HILL, Governor

EDWARD F. JONES, Lieutenant-Governor

FRANK RICE, Secretary of State

ANDREW S. DRAPER, LL. D., Sup't of Pub. Instruction

} *Ex officio*

In order of election by the legislature

GEORGE WILLIAM CURTIS, LL. D., 1864	-	-	West New Brighton
FRANCIS KERNAN, LL. D., 1870	-	-	Utica
MARTIN I. TOWNSEND, LL. D., 1873	-	-	Troy
ANSON J. UPSON, D. D., LL. D., 1874	-	-	Glens Falls
WILLIAM L. BOSTWICK, 1876	-	-	Ithaca
CHAUNCEY M. DEPEW, LL. D., 1877	-	-	New York
CHARLES E. FITCH, 1877	-	-	Rochester
ORRIS H. WARREN, D. D., 1877	-	-	Syracuse
LESLIE W. RUSSELL, LL. D., 1878	-	-	New York
WHITELAW REID, LL. D., 1878	-	-	New York
WILLIAM H. WATSON, M. D., 1881	-	-	Utica
HENRY E. TURNER, 1881	-	-	Lowville
ST CLAIR MCKELWAY, LL. D., 1883	-	-	Brooklyn
HAMILTON HARRIS, LL. D., 1885	-	-	Albany
DANIEL BEACH, LL. D., 1885	-	-	Watkins
WILLARD A. COBB, 1886	-	-	Lockport
CARROLL E. SMITH, 1888	-	-	Syracuse
PLINY T. SEXTON, 1890	-	-	Palmyra
T. GUILFORD SMITH, 1890	-	-	Buffalo

MELVIL DEWEY, M. A., *Secretary* - - - Albany

ALBERT B. WATKINS, Ph. D., *Assistant Secretary* - Albany

Regents' standing committee on the State Museum

ANDREW S. DRAPER, Sup't of Public Instruction, *Chairman*

Regents KERNAN, HARRIS, BEACH AND C. E. SMITH

State Museum staff

JAMES HALL, M. A. (Rensselaer Polytechnic), LL. D. (Harvard)

Director, State Geologist and Paleontologist

CHARLES H. PECK, M. A. (Union) - - - - - *State Botanist*

J. A. LINTNER, Ph. D. - - - - - *State Entomologist*

JOHN C. SMOCK, M. A. (Rutgers), Ph. D. (Lafayette), *Economic Geologist*

JOHN M. CLARKE, M. A. (Amherst) - - - *Assistant Paleontologist*

WILLIAM B. MARSHALL, M. S. (Lafayette) - - *Assistant Zoologist*

PHILIP AST - - - - - *Lithographer*

MARTIN SHEEHY - - - - - *Messenger*

JACOB VAN DELOO - - - - - *Clerk*

STATE OF NEW YORK

No. 75.

IN SENATE

JANUARY 30, 1891

FORTY-FOURTH ANNUAL REPORT

OF THE

NEW YORK STATE MUSEUM

To the Legislature of the State of New York :

I have the honor to submit herewith, pursuant to law, the 44th annual report of the Regents of the University on the New York State Museum.

GEORGE WILLIAM CURTIS

Chancellor

NEW YORK STATE MUSEUM

REPORT OF ASSISTANT IN CHARGE.

REPORT OF DIRECTOR.

To the Regents of the University of the State of New York:

GENTLEMEN:—I have the honor to submit herewith the report of Mr. John C. Smock, lately Assistant-in-charge of the State Museum, containing a summary of the work for the current year, the condition and arrangement of the collections and the additions thereto etc. up to the end of September, 1890.

The retirement of Mr. Smock on the 1st of October has left the records to be completed by Mr. Marshall to the present date.

The Bulletins already published furnish an account of the important work done by Mr. Smock in Economics and by Mr. Marshall the Assistant Zoologist. The annual report of the State Botanist, the State Entomologist and the State Geologist which accompany this report will furnish a record of the work done in these several departments.

The appointment of Dr. Frederick J. H. Merrill as Assistant Geologist and in charge of the Museum has added an efficient and earnest worker to the Museum staff.

Dr. Merrill's specialty is in the direction of geology proper or physical and stratigraphical geology, and his services in that direction will fill an important place in the work of the Museum and in field work preparatory for the geological map, which I regard as of the first and highest importance to the educational interests of the state. Until a geological map of the state can be presented to the student in that department of study there is comparatively little use in placing before him collections of rocks, minerals and fossils, for he has no proper means of associating these objects as he should have with certain localities and areas as within the limits of the state.

With a geological map before him as a source of reference he at once acquires a general knowledge of the geographical distribution of the rocks which furnish fossils and those which furnish the minerals, ores, etc. and will very naturally come to an appre-

ciation and understanding of the order of succession, and the geographical distribution of the geological formations of the state of New York and of their relations to other states. The importance of this knowledge either for a teacher or for a man in any practical department of life becomes of the greatest importance, and is everywhere applicable and useful.

Since Dr. Merrill has already shown a deep and appreciative interest in the Museum, its plans, purposes and its future advancement, he has naturally turned his attention to its present condition, both in the building upon State street, and to the location of departments in the State Hall and the Capitol.

At the present time the Agricultural and Geological Hall on State street is the only available place for collections which are to be arranged for public exhibition. The building scarcely affords accommodation for the officer in charge of the Museum and for the Assistant Zoologist. The State Botanist is located in a room in the State Hall, the State Entomologist has quarters in the Capitol, while the State Geologist and Assistant Palæontologist, with the enormous collections in the latter department together with the draughtsmen occupy rooms in the upper story of the State Hall. It is needless to comment upon the inconvenience coming from these distant and isolated locations, and the barrier it places to free intercourse and consultation among the members of the Museum staff. Nothing would more conduce to harmony and unanimity of purpose and action than the concentration of the Museum staff in a single well lighted and fire proof building, adapted to the wants of a scientific Museum in all its departments of natural history. But I need not dwell upon this aspect of the case; it has already been presented to your honorable body on many occasions.

It should not be forgotten, however, that a natural history museum must necessarily increase its collections, and increase of collections demands additional space. To a considerable extent these collections should be on exhibition and accessible to the public.

Our Museum has been no exception to the general rule of all natural history museums, the world over. In every country of Europe enlargements of space in old buildings or additions to these buildings have been made, or new buildings have been erected, adapted to the ever increasing demand for more space.

The Natural History department of the British Museum offers a good example in point. When the increasing collections demanded more space and the accumulations were stored in basement and cellar to overflowing, the argument for more space became irresistible. Another site was considered important, and many of the trustees were in favor of still retaining the Museum in the heart of London, where a space of three acres could be procured on which to erect a building, and thus separate the Natural History departments from the Library of the British Museum. But the wise counsels of Prof. Owen, after an experience of more than fifty years of service, finally prevailed, and instead of the three acres in the heart of London, the trustees purchased twenty-five acres in Kensington, and the Natural History department of the British Museum with its excellently appointed Laboratories has become the admiration of the whole world.

When I assumed charge of the Museum in 1866, there was abundant space on every floor of the building and the great problem was to find proper material for its occupancy. The Mazatlan collection of shells presented by Dr. Carpenter had been arranged, principally at the eastern end of the room, while other portions of the collection were disposed in space at the western end. Almost at the outset we were able to secure the liberal appropriation of \$5,000, for the purchase of the Gould collection which was arranged in new cases in the central area, and this with the cases of mammals, birds and fishes gave an air of completeness in the arrangement. Mr. Charles Wadsworth had about that time presented a collection of casts of *Megatherium*, skull and tusks of the Sewalik Elephant, the skull of *Dinotherium*, *Glyptodon* et cetera.

These were arranged upon the first floor above the offices. The discovery of the Cohoes *Mastodon* gave us an interesting and important addition to our collections as well as an added impulse in the way of public interest in the Museum.

In order to provide for this and other accessions, the open areas in the floors at either end of the first floor were closed and upon one of the areas thus created upon the second floor were arranged the collection of casts just mentioned, and on the other the *Mastodon* skeleton and the skeleton of the Irish elk, together with separate jaws, skull, teeth and other bones of the *Mastodon* and also casts of a skull, a lower jaw of special interest, together with

tusks and teeth of Elephants. A collection of Tertiary and Cretaceous fossils, and a series of British rock specimens occupied the central portion of the floor. The mineralogical collection was rearranged in the wall cases occupying three sides of the room, including the original Beek collection of the Geological Survey which was preserved intact. This arrangement gave an air of symmetry and completeness to the second floor though still leaving much space, since utilized by other collections. This disposition of the collections left the first floor free for the arrangement of the New York rocks and fossils of which latter large collections were at once added. The disposition of these collections still remains nearly the same as at that time.

The Herbarium of the plants of the state, collected by Dr. Torrey had been neglected and although, through the late Hon G. W. Clinton, by his own labor and otherwise, efforts had been made to secure its preservation and increase, very little progress had been made. At this time and under these circumstances Prof. Charles H. Peck became connected with the Museum having in view the special object of arranging the Herbarium. Mr. Lintner came into the Museum as a general assistant, but soon began to devote himself to his specialty, Entomology. Mr. Peck has become the State Botanist, occupying a large room in the State Hall, with an Herbarium more than one hundred times greater than when he began, and of infinitely more importance both in a scientific and practical point of view. Mr. Lintner has become the State Entomologist, occupying a separate room in the Capitol, and the collection of insects, originally a few small hanging cases of dilapidated specimens, has become one of great extent and importance.

Both the State Botanist and State Entomologist publish annually the results of their investigations, and these reach the schools and intelligent citizens of this and other states.

The collection of building stones and ores of the state, begun by me soon after going into the Museum, has been greatly augmented and the results of the investigations published in several Bulletins.

The immense collections of fossils, which had been made by myself and assistants for the Palæontology of the State, and for which I had originally provided buildings and cases of drawers at my own personal expense has been transferred to the upper story of the State Hall.

Since the period of rearrangement in 1886-1890, the accession of collections in every department has filled and overcrowded the rooms of the State Museum building and lately by cooperation of the Secretary of the Agricultural Society, the Museum has secured communication with, and lodgment in the rooms of the latter for a valuable collection of the woods of the State of New York, and other objects of general interest.

It has not been my intention to go into any detailed account of the progress of the Museum collections, but merely to show that in the place where, a few years since, there was an abundance of space for additional collections, that space is now excessively overcrowded and has overflowed into the Agricultural rooms. Three important departments have been forced to seek quarters elsewhere and still more space is required for the exhibition and storage of collections in several of the departments.

Since Mr. Merrill has come into the Museum he has given especial attention to our needs in regard to additional space for exhibition rooms and for laboratories for the different departments, in order that the Museum staff may do its work efficiently and satisfactorily. I would most earnestly recommend the concentration of the Museum and its offices in a well lighted fire-proof building, where we may have at least *thirty-two thousand square feet available for exhibition purposes alone*, with the possibility of additional space to accommodate the growth and increase in each one of the departments. In addition to this, there should be ample space for offices and laboratories with the convenience of a working library in each one.

The few words at the commencement of my statement are sufficient to show your honorable body the great disadvantages under which we now labor, and these disabilities can only be removed by a concentration of the work and collections under one roof.

In this connection I would beg leave to call your attention to the "*Geological and Natural History Survey*" of the state which has been so long in existence, and which for a long time was carried on single handed and in a single department only. The recognition of a State Botanist and of a State Entomologist by legislative enactment was an extension and continuation of the original plan in the same direction, and intended as a step to a more complete organization. Perhaps the law of 1883

may not have fully repealed all previous laws relating to this object, and if still existing I would ask whether there may not be obtained some small appropriation to be used in carrying out the intention of the framers of the original law and its amendments. While the law organizing the Museum in 1870 and the subsequent one absorbing the department of Geology and Palæontology which had been continued under the original law, may perhaps enable you to carry out to completion all the work originally contemplated by these acts, I will venture to suggest the inquiry whether it may not be well to recognize the term "GEOLOGICAL and NATURAL HISTORY SURVEY" more especially since the original distinctive title of "*The State Museum of Natural History*," established by the law of 1870, has given place to the title of "STATE MUSEUM." I have been induced to speak of this subject since my attention has been called to the matter from several sources, prompted by a desire to see the work of the Geological and Natural History Survey recognized and continued; and even by a proposition from a member of last year's Assembly to organize a new Geological Survey of the State, or reorganize the existing elements and carry out the original plan of a complete work in all the departments of science.

While the Museum in its several departments is doing excellent work and publishing valuable results, I have for a long time hoped that some measures might be devised for reaching, more directly the individual and collective interests of the people of the state.

If the State Museum, the Geological and Natural History Survey, and all the scientific investigations are to be merged in the "*University of the State of New York*," then the University, its scope, its plans, its means and appliances, whether of men, apparatus or of buildings, should be commensurate with the needs and demands of the nearly six millions of people inhabiting the Empire State.

Very respectfully

Your obedient servant

JAMES HALL

Director of the State Museum.

ALBANY, N. Y., December 3, 1890.

STATE MUSEUM, ALBANY, N. Y.

Prof. JAMES HALL, LL. D., *Director New York State Museum :*

SIR:—I beg leave to present the following brief summary of the work for the current year, ending September 30, 1890.

Respectfully submitted,

JOHN C. SMOCK

Assistant-in-charge.

The exhibition is, in general, the same as last year. The mineralogical collection occupies the first story rooms; the New York palæontological collections, the second story, with large specimens of minerals and illustrations of dynamic geology; the Beck collection of minerals from the state, the antiquarian and historical, and the ethnological collections occupy wall cases in the third story room, also the fossils of the cenozoic and recent formations, in table cases. The Mastodon remains and mounted skeleton, the Irish elk, and the Wadsworth collection of casts remain as heretofore, in their old positions on this floor; in the fourth story the zoological department is installed. The building stones are in the lower main hall in shelving on each side of the entrance way. During the year, through an arrangement with the secretary of the New York State Agricultural Society, a passage-way has been cut through from the third story museum room to the top gallery of the rear building. It admits of an easy passage from the one to the other and is a much needed improvement. Through the generous liberality of the Agricultural Society, and its efficient secretary, Mr. Woodward, permission was granted to the Museum authorities to occupy a part of the space on this top gallery. Several of the wall cases have been rearranged and refitted with shelving and new locks. A series of table cases has been put in against the west-side corridor railing. The collection of woods secured for the Museum by contract, from Mr. R. B. Hough, has been set up in the east-side wall cases. They are not yet fully seasoned and are to be dressed as soon as ready and arranged in these cases on permanent exhibition. Nearly all of the remaining cases in this room are filled with the Miller collection, which was placed here on deposit by its owner, Mr. George D. Miller, of Albany. It consists of a large amount of unique and valuable historical and

ethnological material, collected in Egypt, India, China, Japan and Alaska. It is not labeled nor arranged for exhibition. The collection of insects belonging to the Museum, and on exhibition, are also in this top gallery.

The space thus placed at the disposal of the Museum for its increased collections affords relief and the new arrangement adds to the attractiveness of the whole building. More floor space is wanted for the proper placing of cases and for an exhibition which is both instructive and neat. The crowding inevitable where the amount of material is large and is accumulating from year to year, offends the eye and prevents any scientific arrangement.

The additions during the year are enumerated in the appendices to this report. They have been important and valuable. In the mineralogical department the largest addition is that made by Mr. F. L. Nason, who was employed for one month to collect in the Adirondack region and in Putnam and Westchester counties. He obtained about 800 specimens of the more characteristic and showy minerals of these portions of the state. The best of them have been placed on exhibition; the remainder is of value for exchanges and for distribution to schools. Among the notable species thus obtained, the phlogopites and blue calcite from Natural Bridge; the hexagonite from Edwards; the Antwerp chalcodites, hematites and millerite; and the striated feldspar and magnetites from Mineville, may be here mentioned.

In the palaeontological department the Rust collection of fossils, from the Trenton and Hudson river groups, near Trenton Falls, is preeminent. It fills a much needed gap, particularly in its magnificent specimens of trilobites of the Trenton epoch. This collection was purchased by the Museum.

The collection of woods from the state, ordered made last year by the Regents, is in progress. The collector, Mr. R. B. Hough, of Lowville, author of "American Woods," has sent forty-three (43) specimens, representing as many species, to the Museum and they have been put in the cases. It is expected that the remainder, thirty-one (31) specimens, will be obtained during the coming autumn and winter. As soon as seasoned the logs are to have their longitudinal, transverse and oblique sections, dressed and polished. This work is to be done by the collector and at the Museum. The specimens are large and the space needed for

their exhibition will require nearly all of the top gallery cases, but the value and attractiveness of the woods of the state, as shown there, will warrant this outlay.

Although the additions to the collections in the Zoological Department have not been numerous, they include several specimens worthy of particular mention. In April Mr. Charles H. Kingsbury, of Rochester, N. Y. (now of Spokane Falls, Wash.), presented to the Museum the skins of a pair of Rocky Mountain goats and of a pair of Rocky Mountain sheep, all taken by the donor while on a hunting tour in British Columbia. The four specimens have since been properly mounted and are exhibited in the middle case against the east wall of the zoological floor.

Early in the summer of 1890, Forepaugh's circus was exhibiting in Albany. The large elephant "Columbia," belonging to the circus had been injured while being transported by rail and died in June at West Albany, from the effects of the injuries. The hide and skeleton of the elephant were offered to the museum at reasonable prices, and it was deemed desirable that the Museum should purchase the skeleton. The skeleton was accordingly purchased, and shipped to Ward's establishment at Rochester, for maceration preparatory to mounting. The specimen will be mounted and placed on exhibition about October, 1891.

In February the Pupidæ of the Gould collection of shells were loaned to Dr. V. Sterki of New Philadelphia, Ohio, who has made that family of mollusks a special study. Dr. Sterki reidentified the specimens loaned to him; added the more important specific synonyms; and in some cases he has added probable localities to specimens whose localities were unknown.

He enriched the collection of Pupidæ by adding to it ninety-six specimens, representing twenty species new to the collection, of which five species are from North America and twelve from Europe.

Many of the fresh-water shells of the Beecher collection have been cleaned and mounted during the year, but the very limited space available for exhibition purposes does not permit of their exhibition at present. Most of the Unios, Margaritanas and Anodons of this collection are exhibited in the west table case. Many are stored in the drawers beneath the table case. None of the fresh-water univalves have been placed upon exhibition,

but are stored in drawers beneath the west case. As yet none of the land shells are mounted.

In order to economize space and improve the appearance of the floor devoted to zoology, the wall case at the head of the stairs on the south side of the room has been altered to admit of the ratchet system of adjustable shelving. The case contained the larger part of the collection of mounted fishes. The specimens were placed irregularly and were very uninviting. At present the work of fitting the pedestals of the fishes with convenient label-holders is in progress and upon its completion new labels giving more recent nomenclature will be substituted for the old labels. There are now four wall cases which have been fitted with adjustable shelving, viz:— the cases containing the mounted reptiles, the mounted fishes, the alcoholic fishes and the sponges. There remain four cases with immovable shelves which are unsuited to the exhibition of specimens both as regards attractiveness and economy of space.

The collections of mammals and birds have been carefully examined and thoroughly cleaned. So far as could be determined the specimens are free from insect ravages. Owing to the superior construction of the cases containing them the birds and smaller mammals gather little dust. The larger mammals, owing to the fact that the cases containing them, inclose two or more windows and are of rude construction, require much attention to keep them clean.

Bulletin No. 9 of Volume 2, "Beaks of Unionidæ Inhabiting the Vicinity of Albany, New York," has been printed during the year. It consists of twenty-three printed pages (pp. 167-189) and one plate containing eighteen lithographic figures. The bulletin contains descriptions and comparisons of the beak characters of the sixteen species of Unionidæ inhabiting the vicinity of Albany, an account of the value of umbonal characters in making specific discriminations, and general notes upon the species under discussion.

Catalogues in manuscript of the principal portions of the Zoological collections have been prepared. The Mammals, Birds and Birds' eggs, and the Serpents, Turtles, Annelids and Corals, have been catalogued fully, the more recent names now in use being substituted in the catalogue for the older and antiquated names on the labels. The limited time at disposal did not permit

of the preparation of good catalogues of the Batrachians, Lizards, Fishes, and many of the Invertebrates. With the exception of the Beecher collection, the mollusca belonging to the Museum have been catalogued at various times in the annual reports. An appendix transmitted herewith, contains a list of these catalogues.

During the year a large part of my time has been given to the preparation of bulletin No. 10, on building stone in New York. Some field work has been done in the Catskills—collecting notes of the later glacial formations. The usual inquiries asking for information about minerals of economic importance and the general direction and care of the collections and the work incidental to them have taken the time not given to the work of preparing reports.

During the year collections of minerals have been sent to the State Normal School at Oneonta, and to the following schools :

Clyde Union School, Clyde, Wayne county, N. Y.

School No. 2, Elmira, N. Y.

Olean Academy, Olean, Cattaraugus county, N. Y.

Ilion Union School, Ilion, N. Y.

New York Institution for the Blind, Batavia, N. Y.

Belmont School, Belmont, N. Y.

Following the recommendations made to the Board of Regents and concurring in their order, the Potsdam sandstone slabs with trails of trilobites, *Climatichnites Wilsoni*, found near Port Henry, last year, have been distributed to the following museums: American Museum of Natural History, New York; Museum of Comparative Zoology, Cambridge, Mass.; Peabody Museum, Yale University, New Haven, Conn.; Cornell University, Ithaca; U. S. National Museum, Washington, D. C.; and to the Canadian Geological Survey Museum, at Ottawa. A specimen was sent to Columbia College, New York city, as an exchange. A large amount of material, in smaller slabs and fragments remains, which can go into school collections. The museum retains on exhibition two of the largest and best specimens.

The interest of the public as manifested by the number of visitors, has not diminished, and, although no record is kept, it seems to be on the increase. The inquiries, referring to the geological formations of the state and their minerals of value in the arts, which come to the museum, are increasing and attest the value of the institution in the dissemination of valuable information.

ADDITIONS TO THE COLLECTIONS.

ZOOLOGY.

BY DONATION.

Charles H. Kingsbury, Rochester, N. Y.:

Mountain goat (male and female).

Mountain sheep (male and female).

Taken by the donor in "November, 1889, in mountains a few miles back from the Fraser river, B. C., about twenty miles above its junction with the Thompson. These mountains are in the Coast (Cascade) Range, but are on the inside, farthest from the coast."

G. E. Van Guysling, Albany, N. Y.:

Large bat, East Indies.

G. D. Miller, Albany, N. Y.:

Cinnamon Bear (cub).

Harbor Seal (young).

Dr. V. Sterki, New Philadelphia, O.:

Twenty species (ninety-six specimens) of Pupidae, as follows:

Pupa procera, G'd., Washington. D. C., seven specimens.

Pupa hordeacella, Pilsbry, Guadalupe river (drift), Texas, five specimens.

Pupa hordeacea, Gabb, Guadalupe river (drift), Texas, three specimens.

Pupa curvidens, G'd., Northeastern Ohio, twelve specimens.

Vertigo Californica, Rowell, San Francisco, Cal., five specimens.

Vertigo rugosula, var. ovulum, Sterki, Volusia county, Fla., three specimens.

Vertigo Oscariana, Sterki, Volusia county, Fla., three specimens.

Vertigo (Angustula) milium, G'd., Northeastern Ohio, eight specimens.

Pupa (Torquilla) affinis, Rossm., Eastern Pyrenees, two specimens.

Pupa secale, Drap., Jura, Switzerland, four specimens.

Pupa leptochelos, Fagot, Eastern Pyrenees, two specimens.

Pupa (Torquilla) Farinesi, Desm., Eastern Pyrenees, four specimens.

Pupa avenacea, Brug., Jura Mts., Switzerland, nine specimens.

Pupa (Orcula) dolium, Drap., Jura, France, three specimens.

Pupa cylindracma, DaC., Chatillon, Jura, France, four specimens.

Pupa Sterri, Voith., Brugg, Jura, France, six specimens.

Pupa (*Isthmia*) minutissima, Hartm., Switzerland, five specimens,

Vertigo pygmæa, Drap., Jura, France, five specimens.

Vertigo antivertigo, Drap., Jura, France, three specimens.

Vertigo Moulinsiana, Dupuy, Jura, France, three specimens.

Mr. Shufeldt, Albany county, N. Y.:

A hornet's nest (eighteen inches in length and twelve inches in breadth) and the honey-comb belonging thereto; from Albany county, N. Y.

Percy Orton, Northampton, Fulton county, N. Y.:

Two specimens of Grass Snake, *Liopeltis vernalis*, Dekay, Northampton, Fulton county, N. Y.

BY PURCHASE.

One specimen Porcupine, *Erethizon dorsatus*. Kaaterskill Clove, near Palenville, Greene county, N. Y.

The skeleton of the elephant "Columbia," formerly with Forepaugh's circus.

One specimen Red-backed Mouse, *Evotomys rutilus Gapperi*, Vigors Coues, Elk river, Minn.

One specimen Broad-nosed Shrew, *Sorex platyrhinus*, Wagr., Madison county, N. Y.

One specimen Carolina Shrew, *Sorex Carolinensis*, Durham county, N. C.

One specimen Yellow Palm Warbler, *Dendroica palmarum hypochrysea*, Connecticut.

Four specimens of eggs of King Rail, *Rallus elegans*, Aud., Flag Station, Illinois.

List of New York woods, from Mr. R. B. Hough:

<i>Magnolia acuminata</i> , L.	Cucumber tree.
<i>Liriodendron Tulipifera</i> , L.	Tulip tree. White wood.
<i>Tilia Americana</i> , L.	Bass wood.
<i>Ailanthus glandulosus</i> , L.	Ailanthus.
<i>Aesculus Hippocastanum</i> , L.	Horse chestnut.
<i>Robinia Pseudacacia</i> , L.	Locust.
<i>Gymnocladus Canadensis</i> , Lam.	Kentucky Coffee tree.
<i>Prunus serotina</i> , Ehrh.	Wild Black cherry.
<i>Cratægus tomentosa</i> , L. var <i>punctata</i> .	Common Thorn.
<i>Nyssa multiflora</i> , Wang.	Sour Gum. Pepperidge.
<i>Fraxinus Americana</i> , L.	White Ash.
<i>Fraxinus pubescens</i> , Lam.	Red Ash.
<i>Fraxinus sambucifolia</i> , Lam.	Black Ash.

<i>Sassafras officinale</i> , Nees.....	Sassafras.
<i>Ulmus fulva</i> , Michx.....	Slippery Elm.
<i>Ulmus Americana</i> , L.....	White Elm.
<i>Ulmus racemosa</i> , Thomas.....	Rock Elm.
<i>Celtis occidentalis</i> , L.....	Hackberry.
<i>Morus rubra</i> , L.....	Red Mulberry.
<i>Platanus occidentalis</i> , L.....	Sycamore. Button wood.
<i>Juglans cinerea</i> , L.....	Butternut.
<i>Juglans nigra</i> , L.....	Black Walnut.
<i>Carya alba</i> , Nutt.....	Shagbark Hickory.
<i>Carya sulcata</i> , Nutt.....	Big Shellbark Hickory.
<i>Carya amara</i> , Nutt.....	Bitternut.
<i>Quercus rubra</i> , L.....	Red Oak.
<i>Castanea vesca</i> , var. <i>Americana</i>	Chestnut.
<i>Fagus ferruginæa</i> , Ait.....	Beech.
<i>Ostrya Virginica</i> , Willd.....	Hop Hornbeam.
<i>Carpinus Caroliniana</i> , Walt.....	Water Beech.
<i>Betula papyracea</i> , Ait.....	White Birch. Cane Birch.
<i>Betula lutea</i> , Michx.....	Yellow Birch.
<i>Betula lenta</i> , L.....	Sweet Birch.
<i>Alnus incana</i> , Willd.....	Black Alder.
<i>Populus grandidentata</i> , Michx.....	Large toothed Aspen.
<i>Populus balsamifera</i> , L. var <i>candicans</i>	Balm of Gilead.
<i>Populus monilifera</i> , Ait.....	Cotton wood. Necklace Poplar.
<i>Pinus Strobus</i> , L.....	White Pine.
<i>Abies nigra</i> , Poir.....	Black Spruce.
<i>Abies Canadensis</i> , Michx.....	Hemlock.
<i>Larix Americana</i> , Michx.....	Tamarack.
<i>Thuja occidentalis</i> , L.....	Arbor Vitæ. White Cedar.

ECONOMIC GEOLOGY AND MINERALOGY

By DONATION.

Norcross Bros., Worcester, Mass. :

- One ten-inch cube Georgia marble, Georgia.
- One ten-inch cube (dressed) Worcester granite, Worcester, Mass.
- One ten-inch cube Brandford red granite, Brandford, Conn.
- One ten-inch cube Worcester sandstone, East Long Meadow, Mass.
- One ten-inch cube Maynard sandstone, East Long Meadow, Mass.
- One ten-inch cube Kibbe sandstone, East Long Meadow, Mass.

C. C. Stevens :

Two specimens Serpentine, Port Douglas, Essex county, N. Y.

Matthew Van Keuren :

One block of Brecciated rock, Ulster Park, Ulster county, N. Y.

Springfield (Mass.) Emery Wheel Company :

One specimen massive garnet, Minerva, Essex county, N. Y.

A. J. Jennings :

Three blocks of sandstone, Fulton, Oswego county, N. Y.

James Haynes :

One specimen of Radiated pyrite, Lockport, N. Y.

R. S. Hodge, Antwerp, N. Y. :

One specimen of millerite, Antwerp, Jefferson county, N. Y.

Retsof Salt Manufacturing Company :

One block of rock-salt, Piffard, Livingston county, N. Y.

Rev. Thomas Burke, Albany, N. Y.

One block Caen stone from St. Joseph's Roman Catholic Church,
Albany, N. Y. :

W. N. Flint Granite Company :

Two six-inch cubes granite, Monson, Mass.

Isaac Kenwell, Indian Lake, N. Y. :

Lot of garnet and tourmaline, Minerva, Essex county, N. Y.

R. Crill & Son, New York city :

Two blocks öolitic limestone, Indiana.

One block sandstone, Nova Scotia.

One block sandstone, Berea, Ohio.

One block sandstone, Portage, Lake Superior, Mich.

One block sandstone, Belleville, N. J.

BY COLLECTION.

Frank L. Nason :

Epidote, Croft's mine, near Peekskill, thirty-nine specimens.

Feldspar, MacDonald's quarry, Bedford, Westchester county, ninety-five specimens.

Crucite, Tilly Foster mine, Brewsters, Putnam county, twelve specimens.

Serpentine (pseudomorphs), Tilly Foster mine, Brewsters, Putnam county, three specimens.

Quartz crystals, MacDonald's quarry, Bedford, Westchester county, twelve specimens.

Pyroxene, Towners Four-Corners, Putnam county, one specimen.

Feldspar, Ticonderoga, Essex county, three specimens.
 Graphite, Ticonderoga, Essex county, forty-six specimens.
 Labradorite, Mineville, Essex county, seventy specimens.
 Feldspar, Mineville, Essex county, one hundred specimens.
 Garnet, Ticonderoga, Essex county, forty specimens.
 Garnet, Minerva, Essex county, fifty-five specimens.
 Hematite, chalcodite and ankerite, from Antwerp, Jefferson county.
 ninety-six specimens.
 Phlogopite, Natural Bridge, Jefferson county, seventy-four specimens.
 Quartz, coated with calcite, Natural Bridge, Jefferson county, forty-seven specimens.
 Blue calcite, Natural Bridge, Jefferson county, twenty-five specimens.
 Talc and paraphite, Edwards, St. Lawrence county, thirty-three specimens.
 Hexagonite, Edwards, St. Lawrence county, twenty-three specimens.
 Brown tourmaline, three specimens.
 Tremolite, Diana, Jefferson county, twenty-four specimens.
 Magnetite cleavages, Mineville, Essex county.

BY EXCHANGE.

Prof. J. J. Stevenson, New York city:

Crude petroleums, as follows:

Five samples from Kentucky.

Two samples from Terre Haute, Indiana.

One sample from West Virginia.

One sample from South-western Pennsylvania.

Ernest Schernikow, New York city:

Malacolite, Sing Sing, N. Y., two specimens.

Pyromorphite, and wulfenite, Sing Sing, N. Y., two specimens.

Galenite, pyromorphite and vanadinite, Sing Sing, N. Y., one specimen.

Vanadanite and pyromorphite, Sing Sing, N. Y., one specimen.

Massive natrolite Sing Sing, N. Y., one specimen.

Galenite, Sing Sing, N. Y., one specimen.

Harmotome, Sing Sing, N. Y., one specimen.

Pyromorphite, Sing Sing, N. Y., one specimen.

H. S. Peck, Albany, N. Y. :

Diaspore, Chester, Mass.

BY PURCHASE.

W. R. Pierce:

Rhodonite, Franklin Furnace, New Jersey, two specimens.

APPENDIX.

A LIST OF THE CATALOGUES OF SHELLS PUBLISHED IN FORMER ANNUAL REPORTS.

SOURCE.	Description.	Species.	Specimens.	Where catalogued.	Pages.
H. C. DeRham.....	Mostly marine.....	159	.....	Third report,	41-46
Dr. Charles Martin...	Marine.....	251	.....	Seventh report,	29-39
James Lewis.....	New York land and fresh water.	58	.....	Seventh report,	39-41
Dr. Chester Dewey....	New York and Ohio Unios.....	43	.....	Ninth report,	31-38
Dr. Wesley Newcomb.	Land, fresh water and marine.....	217	.....	Eleventh report,	37-42
Hugh Cuming.....	Land and marine.....	140	..... 195	Twelfth report,	103-107
P. F. Carpenter.....	Mostly marine.....	321	2,561	Twelfth report,	102-104
P. P. Carpenter.....	Mazatlan shells.....	421	6,584	Thirteenth report,	21-36
J. G. Anthony.....	Fresh water.....	279	.....	Fifteenth report,	15-21
Smithsonian Inst.....	Duplicates, U. S. Expl. Exped.....	273	.....	Fifteenth report,	23-25
Smithsonian Inst.....	Marine.....	1,008	..... 1,680	Twentieth report (revised),	21-24
Smithsonian Inst.....	Land, fresh water and marine... }	663 + 51 var.	}	Twentieth report (revised),	45-60
Temple Prime.....	Long Island mollusca.....	106	.....	Twenty-fifth report,	35-38
Temple Prime.....	Long Island mollusca.....	15	.....	Twenty-sixth report,	17-18
Smithsonian Inst.....	European shells.....	556	.....	Twenty-fifth report,	39-55
T. H. Aldrich.....	United States land and fresh water.	113	.....	Twenty-seventh report,	43-46
Gould collection.....	Types.....	362	1,060	Twenty-seventh report,	47-55
Gould collection.....	Unionidæ.....	310	2,883	Twenty-fifth report.	68-81
Gould collection.....	Including the two above entries.....	6,000	60,000	(Manuscript cat. with the collection.)	112-115
James Lewis.....	Mostly land and fresh water.....	87	520	Thirty-fifth report,	116-117
James Lewis.....	United States land and fresh water.	70	.....	Thirty-fifth report,	

CATALOGUE OF MOUNTED MAMMALS IN THE COLLECTION, SEPTEMBER 30, 1890.

SCIENTIFIC NAME.	Common name.	Description.
<i>Didelphys Virginiana</i> , Shaw	Opossum	Male and female.
<i>Lepus sylvaticus</i> , Bach.	Wood hare	Three specimens.
<i>Lepus Americanus</i> , Erx.	Northern hare	Male, female and young.
<i>Lepus Americanus</i> , Erx.	Northern hare	One specimen.
<i>Erethizon dorsatus</i> , L.	Canada porcupine	Male.
<i>Erethizon dorsatus</i> , L.	Canada porcupine	Albino.
<i>Zapus Hudsonius</i> , Coues	Jerboa	One specimen.
<i>Fiber zibethicus</i> , L.	Muskrat	Male and female.
<i>Fiber zibethicus</i> , L.	Muskrat	One specimen.
<i>Arvicola pinetorum</i> , LeC.	Pine mouse	One specimen.
<i>Arvicola riparius</i> , Ord.	Meadow mouse	Male and female.
<i>Arvicola riparius</i> , Ord.	Meadow mouse	Male albino.
<i>Evotomys rutilus gapperi</i> , Coues	Red-backed mouse	One specimen.
<i>Hesperomys leucopus</i> , Raf.	White-footed mouse	One specimen.
<i>Mus musculus</i> , L.	Common mouse	Male and two females.
<i>Mus decumanus</i> , Pall.	Brown rat	Male and two females.
<i>Mus decumanus</i> , Pall.	Brown rat	Male (albino), female (pied).
<i>Neotoma floridana</i> , Ord.	Wood rat	One specimen.
<i>Castor fiber</i> , L.	Beaver	Group of two males, one female, two young.
<i>Arctomys monax</i> , L.	Woodchuck	One specimen.
<i>Cynomys ludovicianus</i> , Ord.	Prairie dog	Male and female.
<i>Tamias striatus</i> , L.	Chipmunk	Male.
<i>Tamias striatus</i> , L.	Chipmunk	Three specimens.
<i>Sciurus Hudsonius</i> , Erx.	Red squirrel	Male and female.
<i>Sciurus Hudsonius</i> , Erx.	Red squirrel	Four specimens.
<i>Sciurus Hudsonius</i> , Erx.	Red squirrel	One albino.

<i>Sciurus Carolinensis</i> , Gm.	Grey squirrel.....	Ten specimens.
<i>Sciurus niger</i> , L.	Fox squirrel.....	Five specimens.
<i>Sciuropterus volucella</i> , Gm.	Flying squirrel.....	Male and female.
<i>Sorex platyrhinus</i> , De K.	Broad-nosed shrew.....	One specimen.
<i>Scalops aquaticus</i> , L.	Shrew mole.....	Two specimens.
<i>Scapanus Americanus</i> , Bart.	Hairy-tailed mole.....	Three specimens.
<i>Sorex Carolinensis</i> , Bach.	Carolina shrew.....	Male.
<i>Con. lylura cristata</i> , Illig.	Star-nose.....	Five specimens.
<i>Vespertilio subulatus</i> , Say.	Little brown bat.....	Two males, two females, one young.
<i>Vesperugo noctivagus</i> , LeC.	Silver-haired bat.....	Male and female.
<i>Atalapha noveboracensis</i> , Erx.	New York bat.....	Male and female.
<i>Atalapha cinerea</i> , Bean.	Hoary bat.....	Male.
<i>Cariacus Virginianus</i> , Bodd.	Virginia deer.....	Male.
<i>Cariacus Virginianus</i> , Bodd.	Virginia deer.....	Male albino.
<i>Cervus macrotis</i> , Say.	Mule deer.....	Male.
<i>Cervus Canadensis</i> , Erx.	Wapiti.....	Male and female.
<i>Alce machilis</i> , L.	Moose.....	Male and female.
<i>Rangifer tarandus</i> , L. var. Caribou, Kerr.	Woodland caribou.....	Male.
<i>Antilocapra Americana</i> , Ord.	Prong-horn antelope.....	Three heads.
<i>Aplocerus montanus</i> , Rich.	Mountain goat.....	Male and female.
<i>Ovis montana</i> , Cuv.	Mountain sheep.....	Male and female.
<i>Bison Americanus</i> , Gm.	American bison.....	Male, female and young.
<i>Bison Americanus</i> , Gm.	American bison.....	Stuffed head.
<i>Callocephalus vitulinus</i> , Gm.	Harbor seal.....	Male and young.
<i>Cystophora cristata</i> , Gm.	Hooded seal.....	Male and female.
<i>Lirichechus rosmarus</i> , Godm.	Walrus.....	Male and young.
<i>Procyon lotor</i> , L.	Raccoon.....	Male and two females.
<i>Trsus Americanus</i> , Pall.	Black bear.....	Male.
<i>Ursus Americanus</i> , Pall. var.	Cinnamon bear.....	Cub.
<i>Uutra Canadensis</i> , Turt.	Otter.....	Female.
<i>Mephitis mephitis</i> , Shaw.	Skunk.....	Male and female.

CATALOGUE OF MOUNTED MAMMALS IN THE COLLECTION SEPTEMBER 30, 1890 — (Concluded).

SCIENTIFIC NAME.	Common name.	Description.
<i>Gulo luscus</i> , Briss.	Wolverine	Male.
<i>Mustela Americana</i> , Turt.	Pine marten	Male.
<i>Mustela Pennanti</i> , Erx.	Fisher	Male and female.
<i>Putorius vison</i> , Briss.	American mink	Four specimens.
<i>Putorius erminea</i> , L.	Ermine ..	Six specimens.
<i>Putorius vulgaris</i> , Erx.	Weasel	One specimen.
<i>Vulpes fulvus</i> , Desm.	Red fox	Male and female.
<i>Urocyon cinereo-argentatus</i> , Schr.	Gray fox	Male.
<i>Canis lupus</i> , L.	American wolf	Male and two females.
<i>Canis lupus</i> , var. <i>rufus</i> , Aud.	Red wolf	Male.
<i>Lynx Canadensis</i> , Desm.	Canada lynx	Male.
<i>Lynx rufus</i> , Guld.	Red wild cat.	Male and female.
<i>Felis concolor</i> , L.	American panther	Two males, female, two young.
FOREIGN SPECIES.		
<i>Ornithorhynchus paradoxus</i> , Blumenbach.	Duckbill	One specimen.
<i>Macropus giganteus</i> , Shaw.	Great kangaroo	Female with two young in pouch.
<i>Rhinoceros Indicus</i> , Cuv.	Indian rhinoceros	Male.
<i>Erinaceus Europæus</i> , Buff.	Hedgehog	One specimen.
<i>Camelopardus giraffa</i> , Cuv.	Giraffe	One specimen.

SCIENTIFIC NAME.	Common name.	Description.
<i>Didelphys Virginiana</i> , Shaw.	Opossum	Male and female (skeletons).
<i>Lepus sylvaticus</i> , Bach.	Wood hare.	Skull.
<i>Erethizon dorsatus</i> , L.	Porcupine	Male and female (skeletons).
<i>Fiber zibethicus</i> , L.	Muskrat	Male (skeleton).
<i>Fiber zibethicus</i> , L.	Muskrat	Skull.
<i>Mus decumanus</i> , Pall.	Brown rat.	Skull.
<i>Castor fiber</i> , L.	Beaver	Male and female (skeletons).
<i>Castor fiber</i> , L.	Beaver	Five skulls.
<i>Arctomys monax</i> , L.	Woodchuck	One (skeleton).
<i>Arctomys monax</i> , L.	Woodchuck	Skull.
<i>Sciurus Hudsonius</i> , Erx.	Red squirrel	Female (skeleton).
<i>Sciurus Hudsonius</i> , Erx.	Red squirrel	Skull.
<i>Sciurus Carolinensis</i> , Gm.	Gray squirrel	Male (skeleton).
<i>Sciurus Carolinensis</i> , Gm.	Gray squirrel	Skull.
<i>Sciurus niger</i> , L.	Fox squirrel	Male (skeleton).
<i>Sciuropterus volucella</i> , Gm.	Flying squirrel	Male (skeleton).
<i>Sus scrofa</i> , var domestica.	Domestic hog	Foot.
<i>Delphinus delphis</i> , L.	Dolphin	One skull, one lower jaw.
<i>Physeter macrocephalus</i> , Sh.	Sperm whale	Lower jaw.
<i>Balaenoptera musculus</i> , L.	Fin-back whale	Skeleton.
<i>Cariacus Virginianus</i> , Bodd.	Virginia deer.	Foot.
<i>Cariacus Virginianus</i> , Bodd.	Virginia deer.	Three pairs of antlers.
<i>Cervus Canadensis</i> , Erx.	Wapiti.	Male (skeleton).
<i>Cervus Canadensis</i> , Erx.	Wapiti.	Two pairs of antlers, in dead-lock.
<i>Cervus Canadensis</i> , Erx.	Wapiti.	Skull with antlers.
<i>Alce machlis</i> , L.	Moose	Male (skeleton).

CATALOGUE OF THE COLLECTION OF MAMMALIAN OSTEOLOGY, SEPTEMBER 30, 1890 — (Concluded).

SCIENTIFIC NAME.	Common name.	Description.
<i>Alce machlis</i> , L.	Moose	One pair of antlers.
<i>Rangifer tarandus</i> , var. <i>caribou</i> , Kerr	Woodland caribou	Male and female (antlers).
<i>Antilocapra Americana</i> , Ord.	Pronghorn antelope	Skull.
<i>Ovis montana</i> , Cuv.	Mountain sheep	Skull and horns.
<i>Ovibos moschatus</i> , Blainv.	Musk ox	Skull.
<i>Bison Americanus</i> , Gm.	American bison	Male (skeleton).
<i>Bison Americanus</i> , Gm.	American bison	Skull.
<i>Trichechus rosmarus</i> , Godm.	Walrus	Skull with tusks.
<i>Trichechus rosmarus</i> , Godm.	Walrus	One pair of tusks.
<i>Procyon lotor</i> , L.	Raccoon	Male and female (skeletons).
<i>Ursus Americanus</i> , Pall.	Black bear	Male (skeleton).
<i>Ursus Americanus</i> , Pall.	Black bear	Three skulls.
<i>Lutra Canadensis</i> , Turt.	Otter	Female (skeleton).
<i>Lutra Canadensis</i> , Turt.	Otter	Skull.
<i>Mephitis mephitis</i> , Shaw	Skunk	Skull.
<i>Mustela Americana</i> , Turt.	Pine marten	Male and female (skeletons).
<i>Mustela Americana</i> , Turt.	Pine marten	Two skulls.
<i>Mustela Pennanti</i> , Erx.	Fisher	Male and female (skeletons).
<i>Mustela Pennanti</i> , Erx.	Fisher	Skull.
<i>Putorius vulgaris</i> , Erx.	Weasel	Male (skeleton).
<i>Vulpes fulvus</i> , Desm.	Red fox	Male and female (skeletons).
<i>Vulpes fulvus</i> , Desm.	Red fox	Skull.
<i>Canis lupus</i> , L.	Wolf	Skull.
<i>Lynx Canadensis</i> , Desm.	Canada lynx	Male (skeleton).

Rhinoceros Indicus, Cuv.....	Indian rhinoceros.....	Male (skeleton).
Hippopotamus amphibius, L.....	Hippopotamus	Tooth.
Elephas Indicus.....	Indian elephant.	Skeleton.
Capra ibex, L	Ibex.....	Skull with horns.

REPORT
OF THE
STATE GEOLOGIST,
1890.



REPORT OF THE STATE GEOLOGIST.

To the Regents of the University of the State of New York:

GENTLEMEN.—During the past year, as in former years, since 1883, it has been necessary for the State Geologist to devote his time to the work of preparing and publishing the Palæontology of New York. Volume VIII, (Part I), is now in press, and far advanced toward completion, there being something more than 250 pages in type, and the manuscript prepared for the remainder of the volume as contemplated, to the completion of the Productidæ.

The lithographing of the plates is nearly completed, and this work will be finished before the 1st of January, 1891.

Much work has already been done in the preparation of Part II of this volume. Fifteen plates are already lithographed and drawings prepared, which will make at least six plates more for the second part of the volume. A large amount of material has been collected for study preparatory to the completion of this part of the volume, and the work on much of this material has been advanced so that it is in condition for immediate use.

The State Geologist has also given attention to the forwarding of other work which has been for some time in progress, and especially the Dictyospongidæ and Bryozoa. For the former work the collections have been increased, and some new forms obtained; and for the latter class of fossils, much work has been done preparatory to the completion of the Bulletin which was long since directed to be prepared, but for which no means have yet been provided.

Few opportunities have offered for increasing the collections of the Silurian Lamellibranchiata preparatory to completing the Bulletin on the "GENERA OF PALÆOZOIC LAMELLIBRANCHIATE SHELLS," for which ten plates were already lithographed nine years ago.

I can not but regard it a great misfortune to the reputation of the State Museum, and to its influence as an educating institution, that work already long since commenced, and progressed under

approval and direction of the Trustees, should be suspended indefinitely, while new work has been taken up and carried on to completion.

So long as the work on these groups of organisms can not be published, the subjects remain in mind, and it is quite impossible to drop them from consideration, and take up other work as if these had been completed or had never been commenced.

This condition prevents the conception, planning or forwarding of other work in the same direction, and for which there is great need in our education; and this is moreover a kind of work which the State of New York could easily supply for the benefit of her educators and those who are to be educated.

It is scarcely possible to estimate the loss to the reputation and prestige of the Museum and to the state which has come from the actual suspension of work in these branches for so many years; a loss which the most earnest devotion to that or similar work or publication, in the future, can never repair. Without dwelling further on this unhappy condition of certain departments of work relating to the Palæontology, I would earnestly ask for some positive and final action; even an adverse decision will be preferable to suspense.

The early months of the year were devoted to the supervision of the printing of Part I of volume VIII; the Brachiopoda Inarticulata. The discussions upon the genera of this order together with the descriptions of new species constitute the first 185 pages of the volume.

The scope of this volume is much wider than any of the preceding volumes on the Palæontology of New York, embracing, as proposed, a revision of the genera of the Palæozoic Brachiopoda, and therefore treating of the most numerous and most characteristic forms, as well as the most useful for the identification and determination of the comparative age of the older geological formations of the continent. To accomplish such a work requires the investigation of material from widely separated localities and from all the recognized subdivisions of the entire geological column. It has therefore been necessary to go outside of the limits of the state to obtain material for study, both from the older Palæozoic formations, which are but very meagerly represented in the collections of the State Museum, and also from the later Palæozoic strata which do not exist within the limits of

the State of New York. Moreover the extension of the New York formations beyond the limits of the state in the north, south and west directions, gives other forms than those found within its borders, and enlightens us in regard to the geographical distribution of genera and species, and the varying influences to which they may have been subjected in these wider areas of their original habitat.

The importance of carrying out such views has been recognized in the first part of the volume on the Inarticulate Brachiopods where several genera, known only in the older rocks of Canada, have been introduced and discussed. In the second part of the work, that upon the Articulate Brachiopods, this requirement became even more imperative, since a considerable number of genera and species had been described from the older rocks of Canada by Mr. Billings which had not been recognized elsewhere.

These forms moreover are very important as lying at the basis of our classification of the Articulate division of the Brachiopoda.

On the completion of the printing of Part I, before referred to, I visited the Redpath Museum at Montreal and the Museum of the Geological Survey at Ottawa for the purpose of studying certain imperfectly known forms, and of selecting specimens of such genera and species as would aid in the illustration of the volume in hand, according to its original plan.

Through the kindness of Sir William Dawson I was able to obtain, from the Redpath Museum, a considerable number of interesting forms for study and illustration. At Ottawa the Director of the Geological Survey, through Mr. J. F. Whiteaves, the Palæontologist, granted every possible facility and assistance for the study of the collections in the Museum of the survey, and I was permitted the loan of a large number of specimens for the study of species and genera long since described by Mr. Billings from the older geological formations. These species, in the progress of study of the Brachiopoda, during recent years, have become extremely interesting and important, as being the earliest forms exhibiting the incipience of certain types of structure which have become more fully developed in later geological periods. The collections thus obtained have been of the greatest importance in the preparation of the plates, the illustration and

discussion of the generic relations of the older forms among the Articulate Brachiopods, and in tracing the lineal descent of certain generic features from their earliest appearance in the Cambrian period.

In this connection I should also make my acknowledgments to Mr. Geo. F. Matthew of St. John for the loan of specimens, both of the inarticulate and articulate forms of Brachiopoda, represented in the genera ACROTHELE, ACROTRETA, LINGULELLA, LINNARSSONIA, KUTORGINA, and ORTHIS-PROTORTHIS, all from the Cambrian of New Brunswick. Also for his valuable notes and suggestions regarding some of the genera which will be fully acknowledged in the text of the volume.

After returning from Montreal and Ottawa I visited many of the public and private collections of Indiana, Illinois, Missouri and Kansas and obtained the loan of material which has been very useful in completing the illustrations and discussion of generic forms of the Carboniferous period.

I have been heretofore, in 1888, and am now again, indebted to the Trustees of the Illinois State Museum, through Dr. Lindahl, the Curator of the Museum for the loan, in the first instance, of their very fine collection of Spiriferoids. During the past summer Dr. Lindahl, at my request, has sent down to the State Hall, for use in the preparation and completion of volume VIII, the entire typical collection of ORTHIS, the streptorhynchoid forms under several genera, the CHONETES and PRODUCTUS from the Illinois State Museum. These have been of essential service in the progress of the work.

The University of Missouri granted me the privilege of selecting from their collections, for study and comparison, a series of specimens illustrating certain species described by Prof. Swallow while State Geologist of Missouri. These specimens have been of essential service in comparing species and of correcting erroneous views regarding certain genera and species current in the catalogues.

From the beginning of the work the Trustees of the American Museum of Natural History have granted the privilege of using such material in the collections of that institution as might be needed in the progress of this work on the Brachiopoda. This privilege has been of great advantage, since these collections contain the types and typical specimens of many of the genera of the

Palaeozoic Brachiopoda, which were described more than twenty years since.

I may also in this place be permitted to make special acknowledgment to the following gentlemen for the loan of specimens from their private collections in aid of this work upon the Brachiopoda since its commencement in 1888.

In my first efforts to obtain specimens for the illustration of the volume I was indebted to Mr. Thomas A. Greene of Milwaukee for the loan of large collections of the Inarticulate Brachiopoda of the genera *Trimerella*, *Monomerella*, *Dinobolus*, etc., from the Niagara group of Milwaukee and adjacent localities, which have been used in the discussion of certain genera and are illustrated upon the plates of the volume. He has also loaned from his collection of Silurian Articulate Brachiopoda specimens of the genera *Orthis*, *Orthotetes*, *Leptæna*, *Strophodonta*, *Rafinesquina*, *Spirifer*, *Pentamerus*, *Rhynchonella*, and several *Athyroid* genera, etc., for use in the second part of the volume.

To Prof. J. S. Newberry, of Columbia College, for specimens of *Orthis*, *Athyris*, *Spirifer*, *Pentamerus*, *Rhynchonella* and *Camarella* from the Silurian; *Rhynchonella*, *Leiorhynchus* and *Meristella* from the Devonian; and of *Lingula*, *Orbiculoidea*, *Orthis*, *Enteletes*, *Derbya*, *Productus*, *Spirifer*, *Syringothyris*, *Athyris* and *Dielasma* from the Carboniferous.

To Prof. J. M. Safford, State Geologist of Tennessee, I am under obligations for the loan of a very important collection of *Orthids*, representing several little known Lower Silurian species; also for an interesting collection of *Scenidium* from the same geological horizon.

To Prof. Edward Orton, State Geologist of Ohio, I am indebted for specimens of *Lingula*, *Orbiculoidea* and *Trimerella* of the Inarticulate Brachiopods and of *Orthis*, *Strophomena*, *Triplecia*, *Meristella*, *Spiriferina*, etc., from the Silurian and Carboniferous formations.

To Prof. C. S. Herrick, of Denison University, now of the University of Cincinnati, for specimens of *Orbiculoidea*, *Orthis*, *Spirifera*, *Spiriferina*, and *Syringothyris* from the Waverly group of Ohio.

To Prof. J. P. Lesley, State Geologist of Penna., for specimens of *Orbiculoidea* of the Devonian.

To Prof. G. C. Broadhead, of the University of Missouri, for specimens of *Enteletes*, *Chonetes*, *Derbya* and *Productus* from the Upper Coal Measures.

To Prof. J. R. Eaton, of William Jewell College, Liberty, Mo., for specimens of a remarkable form of *Productus* from the Upper Carboniferous limestone.

To Chas. D. Walcott, of the United States Geological Survey, for *Orthis-Protorthis* of the Cambrian.

To Prof. S. Calvin, of the University of Iowa for specimens of *Spirifer*, *Stricklandinia*, *Pentamerus*, *Orthis*, *Strophonella*, *Chonetes*, *Enteleles* and *Derbya* from the Silurian, Devonian and Carboniferous formations.

To the Rev. H. Herzer, of Berea, Ohio, for *Lingula* and *Orbiculoidea* of the Waverly group.

To Dr. C. Rominger, of Ann Arbor, Mich., for *Chonetes*, *Derbya* and *Productus* of the upper Carboniferous.

To Prof. E. W. Claypole, of Buchtel College, Akron, Ohio, for specimens of *Lingula* from the Waverly group.

To President E. S. Brainerd and Prof. Henry M. Seeley, of Middlebury College, Middlebury, Vt., for specimens of *Orthis*, *Triplecia* and other fossils from the Calciferous beds at Fort Cassin, Vermont.

To Prof. G. H. Perkins, of the University of Vermont, Burlington, Vt., for specimens of *Orthis*, *Triplecia*, etc., from the Calciferous beds of Fort Cassin, Vermont.

To Mr. W. C. Egan, of Chicago, Brachiopoda of the Niagara group, and *Spirifera*, *Athyris*, *Enteleles*, etc., from the Carboniferous.

To Mr. E. E. Teller, of Milwaukee, Wis., specimens of *Spirifera radiata* and *Spirifera nobilis* of the Niagara group.

To Mr. F. A. Sampson, of Sedalia, Mo., specimens of *Orbiculoidea* from the Choteau limestone and Coal Measures.

To Mr. F. A. Blair, Commissioner of the Geological Survey of Missouri, Sedalia, Mo., a collection of Brachiopoda, Lamellibranchiata, etc., from the Choteau group; donated to the Museum.

To Rev. John Bennett, of Kansas City, Kansas, for the loan of specimens of *Derbya*, *Productus*, *Enteleles*, etc., from the Upper Coal Measures.

To Mr. Wm. H. R. Lykins, of Kansas City, Mo., *Orbiculoidea*, *Productus*, *Aulacorhynchus*, etc., from the Upper Coal Measures.

To Mr. S. J. Hare, of Kansas City, Mo., for specimens of *Orbiculoidea*, *Derbya*, *Productus*, *Spirifera*, etc., from the Upper Coal Measures.

To Mr. F. W. McIntosh, of Kansas City, Mo., specimens of *Productus* from the Upper Coal Measures.

To Prof. Joseph Moore, of Earlham College, Richmond, Ind., a new species of *Pentamerus*, *Strophomena*, etc., from the Silurian.

To Mr. Walter R. Billings, of Ottawa, Ontario, Can., specimens of *Lingula*, *Elkania*, *Obolella*, *Orthisina*, *Camerella*, *Zygospira* of the Cambrian and Silurian.

To Mr. B. E. Walker, of Toronto, Ontario, Can., specimens of *Orbiculoidea*, *Orthis flabellum*, *Stricklandinia* of the Niagara.

To Col. C. C. Grant, of Hamilton, Ontario, Can., specimens of *Orbiculoidea*.

To Prof. Thomas Stowell, of Potsdam, N. Y., specimens of *Lingula*, *Orbiculoidea*, *Orthostrophia*, *Strophonella*, and *Strophodonta* from the Silurian and Devonian.

To Prof. W. L. Brownell, Syracuse, N. Y., specimens of *Triplecia* of the Trenton limestone, and other fossils.

To Mr. E. B. Knapp, of Skaneateles, N. Y., specimens of *Orthis*, *Rhynchonella* and other fossils from the Tully limestone.

To Mr. D. S. Chatfield, of Syracuse, N. Y., a numerous collection of *Athyris*, *Spirifera*, *Trematospira*, *Leiorhynchus*, *Rhynchonella* and other fossils, principally of Devonian and Carboniferous age.

I have elsewhere written that almost at the commencement of this work I secured the services of Mr. Charles Schuchert, as private assistant, with the privilege of having the use of his extensive collection of *Brachiopoda*, in the preparation of this volume, while his knowledge of this class of fossils has been made available in many ways in the advancement of the work.

In the progress of the work on volume VIII, *one hundred and fifty-four* genera of the *Brachiopoda* have been discussed in 325 pages of text and illustrated on forty-one lithographic plates leaving one hundred and six to be treated in the second part of the volume. This latter number will be somewhat increased by the necessity for subdividing some of the groups now included under a single generic name. I have herewith communicated a list of all recognized genera which have been already studied and now form a part of the volume which is nearly completed. This list is so arranged that the comparative value of each term is expressed in the character of the type used, as explained in a prefatory note.

The Genera of *Brachiopoda* still requiring final study and revision, especially in some of the groups, are given in a separate list following the first and in uniform type, therefore expressing no opinion regarding their comparative value.

It may however be proper for me to state in this place that for the illustration of the genera included in this list there are

already fifteen plates lithographed and printed to the number of 3,000 copies of each, and one plate not printed. There are also original drawings to the number of more than three hundred figures, showing that the work of illustration is very far advanced.

It is undoubtedly true that the most difficult part of the entire work has been accomplished viz.: that upon the Brachiopoda Inarticulata entire, and also that upon the earlier Articulates of the Primordial or of the Cambrian and Lower Silurian faunas, leaving the remaining work to be done among groups which are less obscure and their relations and already better understood than were those of the earlier types of this division of the Brachiopoda.

I.

THE GENERA OF THE PALÆOZOIC BRACHIOPODA.

[During the progress of the work preparatory for volume VIII of the Palæontology of New York it became evident that any attempt at a classification of the genera into families would become extremely embarrassing, and of no permanent value. This fact was altogether due to the progress of our knowledge during the past twenty-five years and to the comparative completeness of the material under examination, which was sufficient to show that the accepted subdivisions required important modifications before any satisfactory order could be brought out. For these reasons it was deemed wiser to defer any such attempt and reserve the discussions of the mutual relations of the genera for separate chapters. The palæozoic genera of the Brachiopoda Inarticulata entire, and of the genera of the Articulata in part, from *Orthis* to *Productus* inclusive, in that line of arrangement, have been finally reviewed in accordance with the following list, as far as the names in heavy-faced type extend, and this part of the list, therefore represents the order of treatment and to some extent the present understanding of the value of these genera.

All non-binomial or prae-Linnean terms are omitted.

Terms which are recognized, but with a subordinate value, are inset, while undoubted synonyms are in italics.]

I. Brachiopoda Inarticulata.

- | | |
|---|--|
| 1. Lingula , Brugulère, 1789. | 12. Dinobolus , Hall, 1871. |
| 2. Dignomia , Hall, 1871. | 13. (<i>Conradia</i> , Hall, MS., 1862.) |
| 3. Glossina , Phillips, 1848. | 14. <i>Obolellina</i> , Billings, (<i>partim</i>), 1871. |
| 4. <i>Pharetra</i> , Bolten, 1798. | 15. Monomerella , Billings, 1871. |
| 5. <i>Lingularius</i> , Duméril, 1806. | 16. Rhinobolus , Hall, 1871. |
| 6. Lingulops , Hall, 1871. | 17. <i>Lingulella</i> , Salter, 1866. |
| 7. Lingulasma , Ulrich, 1889. | 18. <i>Lingulepis</i> , Hall, 1863. |
| 8. Lakhmina , Ehlert, 1887. | 19. Barroisella , gen. nov. |
| 9. <i>Davidsonella</i> , Waagen, 1885. | 20. <i>Tomasina</i> , gen. nov. |
| 10. Trimerella , Billings, 1862. | 21. <i>Obolella</i> , Billings, 1861. |
| 11. Gotlandia , Dall, 1870. | |

22. *Leptobolus*, Hall, 1871.
 23. *Elkania*, Ford, 1886.
 24. *Billingsia*, Ford, 1886.
 25. *Paterula*, Barrande, 1879.
 26. *Obolus*, Eichwald, 1829.
 27. *Ungula*, Pander, 1830.
 28. *Ungulites*, Bronn, 1848.
 29. *Aulonotreta*, Kutorga (*partim*), 1848.
 30. *Aulonotreta*, Kutorga, 1848.
 31. *Aeritis*, Volborth, 1869.
 32. *Schmidtia*, Volborth, 1869.
 33. *Monobolina*, Salter, 1865.
 34. *Neobolus*, Waagen, 1885.
 35. *Spondylobolus*, McCoy, 1852.
 36. *Mickwitzia*, Schmidt, 1888.
 37. *Schizobolus*, Ulrich, 1886.
 38. *Discinolepis*, Waagen, 1885.
 39. *Kutorgina*, Billings, 1861.
 40. *Schizopholis*, Waagen, 1885.
 41. *Volborthia*, von Möller, 1873.
 42. *Iphidea*, Billings, 1872.
 43. *Acrothele*, Linnarsson, 1876.
 44. *Acrotreta*, Kutorga, 1848.
 45. *Conotreta*, Waleott, 1889.
 46. *Discinopsis*, gen. nov. (Matthew).
 47. *Linnarssonia*, Waleott, 1885.
 48. *Mesotreta*, Kutorga, 1848.
 49. *Siphonotreta*, de Verneuil, 1845.
 50. *Schizambon*, Waleott, 1884.
 51. *Keyserlingia*, Pander, 1861.
 52. *Helmersen*, Pander, 1861.
 53. *Orbiculoidea*, d'Orbigny, 1847.
 54. *Discina*, auctorum, non Lamarek, 1819.
 55. *Orbicula*, auctorum, non Sowerby, 1822.
 56. *Schizotreta*, Kutorga, 1848.
 57. *Orbiculoidea*, Davidson, 1856.
 58. *Lindströmella*, sub-gen. nov.
 59. *Øhlertella*, sub-gen. nov.
 60. *Lingulodiscina*, Whitfield, 1890.
 61. *Rømerella*, sub-gen. nov.
 62. *Trematis*, Sharpe, 1847.
 63. *Orbicella*, d'Orbigny, 1847.
 64. *Schizocrania*, Hall and Whitfield, 1875.
 65. *Crania*, Retzius, 1781.
 66. *Anomia*, Linné, 1760 (*partim*).
 67. *Ostracites*, Beuth, 1776.
 68. *Patella*, Müller, 1776.
 69. *Numulus*, Waller, 1778.
 70. *Criopus*, Poli, 1791.
 71. *Criopoderma*, Poli, 1795.
 72. *Orbicula*, Cuvier, 1798.
 73. *Orbicularius*, Duméril, 1806.
 74. *Craniolites*, Schlottheim, 1820.
 75. *Choniopora*, Schauroth, 1854.
 76. *Pseudocrania*, McCoy, 1851.
 77. *Palæocrania*, Eichwald, 1860.
 78. *Craniella*, Øhlert, 1888.
 79. *Cardinocrania*, Waagen, 1885.
 80. *Pholidops*, Hall, 1859.
 81. *Patellites*, Schlottheim, 1820.
 82. *Craniops*, Hall, 1859.

II. Brachiopoda Articulata.

83. *Orthis*, Dalman, 1828.
 84. *Orthis sensu stricto*.
 85. *Orthambonites*, Pander, 1830.
 86. *Hebertella*, sub-gen. nov.
 87. *Plectorthis*, sub-gen. nov.
 88. *Mystilea*, sub-gen. nov.
 89. *Plæsiomys*, sub-gen. nov.
 90. *Orthostrophia*, Hall, 1883.
 91. *Platystrophia*, King, 1850.
 92. *Heterorthis*, sub-gen. nov.
 93. *Bilobites*, Linné, 1775.
 94. *Dicelosis*, King, 1850.
 95. *Dalmanella*, sub-gen. nov.
 96. *Rhipidomella*, Øhlert, 1890.
 97. *Rhipidomys*, Øhlert, 1887.
 98. *Schizophoria*, King, 1850.
 99. *Orthotichia*, sub-gen. nov.
 100. *Enteleles*, Fischer de Waldheim, 1830.

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| 101. <i>Syntrielasma</i> , Meek and Worthen, 1865. | 128. <i>Leptagonia</i> , McCoy, 1844. |
| 102. <i>Protorthis</i> , gen. nov. | 129. <i>Rafinesquina</i> , gen. nov. |
| 103. <i>Billingsella</i> , gen. nov. | 130. <i>Strophodonta</i> , Hall, 1850. |
| 104. <i>Scenidium</i> , Hall, 1860. | 131. <i>Douvillina</i> , Ehlert, 1887. |
| 105. <i>Mystrophora</i> , Kayser, 1871. | 132. <i>Brachyprion</i> , Shaler, 1865. |
| 106. <i>Clitambonites</i> , Pander, 1830. | 133. <i>Leptostrophia</i> , sub-gen. nov. |
| 107. <i>Pronites</i> , Pander, 1830. | 134. <i>Amphistrophia</i> , sub-gen. nov. |
| 108. <i>Gonambonites</i> , Pander, 1830. | 135. <i>Strophonella</i> , Hall, 1879. |
| 109. <i>Hemipronites</i> , Pander, 1830. | 136. <i>Plectambonites</i> , Pander, 1830. |
| 110. <i>Orthisina</i> , d'Orbigny, 1847. | 137. <i>Leptaena</i> , Davidson, 1856. |
| 111. <i>Polytœchia</i> , gen. nov. | 138. <i>Christiania</i> , gen. nov. |
| 112. <i>Orthidium</i> , gen. nov. | 139. <i>Davidsonia</i> , Bouchard, 1849. |
| 113. <i>Strophomena</i> , Rafinesque, 1825. | 140. <i>Leptænisca</i> , Beecher, 1890. |
| 114. <i>Orthothetes</i> . Fischer de Waldheim, 1829. | 141. <i>Chonetes</i> , Fischer de Waldheim. |
| 115. <i>Hipparionyx</i> , Vanuxem, 1842. | 142. <i>Chonetina</i> , Krotow, 1888. |
| 116. <i>Derbya</i> , Waagen, 1884. | 143. <i>Anoplia</i> , gen. nov. |
| 117. <i>Kayserella</i> , gen. nov. | 144. <i>Chonostrophia</i> , gen. nov. |
| 118. | 145. <i>Chonopectus</i> , gen. nov. |
| 119. <i>Meekella</i> . White and St. John, 1868. | 146. <i>Chonetella</i> , Waagen, 1884. |
| 120. <i>Streptorhynchus</i> , King, 1850. | 147. <i>Daviesiella</i> , Waagen, 1884. |
| 121. <i>Triplecia</i> , Hall, 1859. | 148. <i>Strophalosia</i> , King, 1844. |
| 122. <i>Dicraniscus</i> , Meek, 1872. | 149. <i>Leptænalosia</i> , King, 1845. |
| 123. <i>Mimulus</i> , Barrande, 1879. | 150. <i>Orthothrix</i> , Geinitz, 1847. |
| 124. <i>Streptis</i> , Davidson, 1881. | 151. <i>Aulosteges</i> , von Helmersen, 1847. |
| 125. <i>Leptella</i> , gen. nov. | 152. <i>Productus</i> , Sowerby, 1812. |
| 126. <i>Leptænulopsis</i> , Haupt, 1878. | 153. <i>Productella</i> , Hall, 1867. |
| 127. <i>Leptæna</i> , Dalman, 1828. | 154. <i>Marginifera</i> , Waagen, 1884. |
| | 155. <i>Proboscidea</i> , Ehlert, 1887. |
| | 156. <i>Etheridgina</i> , Ehlert, 1887. |

[The genera in the remainder of this list have not yet been critically studied. It is therefore not the intention to express the respective values of the terms given below. The list will serve to indicate the amount of work still necessary to complete the revision of the palæozoic genera of Brachiopoda.]

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| 157. <i>Eichwaldia</i> , Billings, 1858. | 167. <i>Reticularia</i> , McCoy, 1844. |
| 158. <i>Dictyonella</i> , Hall (MS.), 1867. | 168. <i>Delthyris</i> , Dalman, 1828. |
| 159. <i>Aulacorhynchus</i> , Dittmar, 1872. | 169. <i>Martiniopsis</i> , Waagen, 1883. |
| 160. <i>Isogramma</i> , Meek and Worthen, 1873. | 170. <i>Ambocœlia</i> , Hall, 1860. |
| 161. <i>Spirifer</i> , Sowerby, 1815. | 171. <i>Spiriferina</i> , d'Orbigny, 1847. |
| 162. <i>Trigonotreta</i> , König, 1825. | 172. <i>Mentzelea</i> , Quenstedt, 1871. |
| 163. <i>Choristites</i> , Fischer de Waldheim, 1825. | 173. <i>Cyrtia</i> , Dalman, 1828. |
| 164. <i>Fusella</i> , McCoy, 1844. | 174. <i>Cyrtina</i> , Davidson, 1858. |
| 165. <i>Brachythyris</i> , McCoy, 1844. | 175. <i>Syringothyris</i> , Winchell, 1863. |
| 166. <i>Martinia</i> , McCoy, 1844. | 176. <i>Athyris</i> , McCoy, 1844. |
| | 177. <i>Spirigera</i> , d'Orbigny, 1847. |
| | 178. <i>Seminula</i> , McCoy, 1844. |

179. *Actinoconchus*, McCoy, 1844.
180. *Euthyris*, Quenstedt, 1871.
181. *Cleiothyris*, King, 1850.
182. *Spirigerella*, Waagen, 1883.
183. *Kayseria*, Davidson, 1882.
184. *Merista*, Suess, 1851.
185. *Camarium*, Hall, 1859.
186. *Meristella*, Hall, 1860.
187. *Meristina*, Hall, 1867.
188. *Charionella*, Billings, 1861.
189. *Whitfieldia*, Davidson, 1882.
190. *Pentagonia*, Cozzens, 1846.
191. *Goniocoelia*, Hall, 1861.
192. *Bifida*, Davidson, 1882.
193. *Nucleospira*, Hall, 1859.
194. *Retzia*, King, 1850.
195. *Rhynchospira*, Hall, 1859.
196. *Trematospira*, Hall, 1857.
197. *Acambona*, White, 1861.
198. *Eumetria*, Hall, 1861.
199. *Trigeria*, Bayle, 1878.
200. *Uncites*, Defrance, 1825.
201. *Uncinella*, Waagen, 1883.
202. *Dayia*, Davidson, 1881.
203. *Hindella*, Davidson, 1882.
204. *Atrypa*, Dalman, 1828.
205. *Spirigerina*, d'Oribigny, 1847.
206. *Zygospira*, Hall, 1862.
207. *Orthonomæa*, Hall, 1858.
208. *Stenoschisma*, Hall, 1847 = of Conrad.
209. *Cœlospira*, Hall, 1863.
210. *Glassia*, Davidson, 1882.
211. *Anazyga*, Davidson, 1882.
212. *Grünewaldtia*, Tschernyschew, 1885.
213. *Karpinskia*, Tschernyschew, 1885.
214. *Anoplotheca*, Sandberger, 1856.
215. *Rhynchonella*, Fischer de Waldheim, 1809.
216. *Cyclothyris*, McCoy, 1844.
217. *Hypothyris*, Phillips, 1841.
218. *Wilsonia*, Quenstedt, 1871.
219. *Uncinulus*, Bayle, 1878.
220. *Terebratuloiden*, Waagen, 1883.
221. *Rhynchotema*, Hall, 1860.
222. *Stenoschisma*, Hall, 1867.
223. *Rhynchopora*, King, 1856.
224. *Rhynchoporina*, Ehlert, 1887.
225. *Rhynchotreta*, Hall, 1879.
226. *Eatonia*, Hall, 1857.
227. *Liorhynchus*, Hall, 1860.
228. *Conchidium*, Linné, 1760.
229. *Pentamerus*, Sowerby, 1813.
230. *Gypidia*, Dalman, 1828.
231. *Gypidula*, Hall, 1867.
232. *Branconia*, Gagel, 1890.
233. *Zdimir*, Barrande, 1881.
234. *Sieberella*, Ehlert, 1887.
235. *Antirhynchonella*, Quenstedt, 1871.
236. *Pentamerella*, Hall, 1867.
237. *Stenoschisma*, Conrad, 1839.
238. *Camarophoria*, King, 1845.
239. *Anastrophia*, Hall, 1867.
240. *Brachymerus*, Shaler, 1865.
241. *Camarella*, Billings, 1859.
242. *Stricklandia*, Billings, 1859.
243. *Stricklandinia*, Billings, 1863.
244. *Amphigenia*, Hall, 1867.
245. *Clorinda*, Barrande, 1879.
246. *Lycophoria*, Lohusen, 1885.
247. *Porambonites*, Pander, 1830.
248. *Isorhynchus*, King, 1850.
249. *Riechthofenia*, Kayser, 1881.
250. *Lyttonia*, Waagen, 1883.
251. *Oldhamina*, Waagen, 1883.
252. *Stringocephalus*, Defrance, 1827.
253. *Terebratula*, Müller, 1776.
254. *Dielasma*, King, 1850.
255. *Epithyris*, King, 1850.
256. *Waldheimia*, King, 1850.
257. *Magallania*, Bayle, 1880.
258. *Cryptacanthia*, White and St. John.
259. *Eudesia*, King, 1850.
260. *Hemiptychina*, Waagen, 1883.
261. *Centronella*, Billings, 1859.
262. *Cryptonella*, Hall, 1861.
263. *Renssellaria*, Hall, 1859.
264. *Renssellandia*, Hall, 1867.
265. *Megalanteris*, Suess, 1856.
266. *Newberria*, Hall, 1891.
267. *Leptocœlia*, Hall, 1857.
268. *Tropidoleptus*, Hall, 1857.
269. *Vitulina*, Hall, 1860.

I.

ORIGINAL DRAWINGS FOR THE PALÆONTOLOGY OF
NEW YORK, VOLUME VIII.

In order that full credit may be given to the several artists who have contributed to the illustration of the volume, the following explanation of the source of the figures is given. Since this work was commenced many years ago important changes have occurred in the organization then existing, and not a single draughtsman has been continued from the commencement. Some of the drawings especially of the Productidæ and others were made by Mr. F. B. Meek*, and his work was followed by that of Mr. R. P. Whitfield. As these plates were printed the name of the person who had done the greatest number of figures was usually given at the bottom of the plate as delineator.† In some cases it may be possible that equal justice has not been done. In order to meet this question and to do equal and exact justice to every one who has contributed to this work the following list of figures and their authors has been compiled. In the explanations of the Plates of the Brachiopoda Articulata, beginning with Plate V, the name of the author of each original drawing will be given.

PALÆONTOLOGY OF NEW YORK, VOLUME VIII.

LIST OF FIGURES UPON THE LITHOGRAPHIC PLATES ACCOMPANYING
PART I OF VOL. VIII BRACHIOPODA INARTICULATA, WITH THEIR
AUTHORSHIP.

[On the pages of explanations accompanying the plates to the second part of this work, upon the BRACHIOPODA ARTICULATA, a statement is given of the authorship of each one of the original drawings; the name appearing at the bottom of the plate as delineator being that of the draughtsman to whom the largest number of drawings is to be credited. These statements in detail were not given on the explanations of the plates in Part I and are hence inserted here. All the plates for this part of the work have been drawn on stone by Mr. PHILIP AST.]

*Originally for the Report on the Geological Survey of Iowa.

† By arrangement among the draughtsmen themselves.

PLATE I.

Figs. 1-20. E. EMMONS.
 21-22. Copies.
 23. E. EMMONS.
 24. R. P. WHITFIELD*.

Figs. 25-30. E. EMMONS.
 31. Copy.
 32-34. E. EMMONS.
 35-36. R. P. WHITFIELD.

PLATE II.

Figs. 1-8. E. EMMONS.
 9-13. R. P. WHITFIELD.
 14-30. E. EMMONS.
 31-33. R. P. WHITFIELD.
 34-36. E. EMMONS.

Figs. 37. R. P. WHITFIELD.
 38-39. E. EMMONS.
 40-41. R. P. WHITFIELD.
 42-44. E. EMMONS.

PLATE III.

Figs. 1, 2. E. EMMONS.
 3. R. P. WHITFIELD.
 4-6. E. EMMONS.
 7. R. P. WHITFIELD.
 8-10. E. EMMONS.

Figs. 11. R. P. WHITFIELD.
 12. E. EMMONS.
 13. R. P. WHITFIELD.
 14-44. E. EMMONS.

PLATE IV.

Figs. 1-5. Copies.
 6-9. E. EMMONS.
 10, 11. R. P. WHITFIELD.
 12-15. E. EMMONS.
 16. R. P. WHITFIELD.

Figs. 17-20. E. EMMONS.
 21-26. Copies.
 27-30. E. EMMONS.
 31. Copy.
 32-38. E. EMMONS.

PLATE IVa.

Figs. 1, 2. E. EMMONS.
 3. J. M. CLARKE.
 4-6. E. EMMONS.

Figs. 7-9. R. P. WHITFIELD.
 10. E. EMMONS.

PLATE IVb.

Figs. 1. E. EMMONS.
 2-5. R. P. WHITFIELD.
 6. J. M. CLARKE.
 7. R. P. WHITFIELD.
 8. J. M. CLARKE.
 9. E. EMMONS.

Figs. 10, 11. J. M. CLARKE.
 12-15. E. EMMONS.
 16-20. R. P. WHITFIELD.
 21. J. M. CLARKE.
 23-25. E. EMMONS.

PLATE IVc.

Figs. 1-15. E. EMMONS.
 16. J. M. CLARKE.

Figs. 17, 18. E. EMMONS.

* The drawings credited to Mr. Whitfield, both in the Brachiopoda Inarticulata and the Brachiopoda Articulata, were all done by him in the early preparation for this volume between 1868 and 1875. Some of the figures used, however, are from drawings of older date and have appeared in previous works of the author.

PLATE IVd.

Figs. 1-6. E. EMMONS.
7. J. M. CLARKE.

Figs. 8-15. E. EMMONS.

PLATE IVc.

Figs. 1, 2. E. EMMONS.
3. Copy.
4-7. E. EMMONS.
8. Copy.
9. R. P. WHITFIELD.
10, 11. E. EMMONS.

Figs. 12. R. P. WHITFIELD.
13, 14. E. EMMONS.
15-18. R. P. WHITFIELD.
19-28. E. EMMONS.
29. R. P. WHITFIELD.
30, 31. E. EMMONS.

PLATE IVf.

Figs. 1-28. E. EMMONS.
29. Copy.
30. E. EMMONS.

Figs. 31. Copy.
32. E. EMMONS.

PLATE IVg.

Figs. 1-4. E. EMMONS.
5-8. R. P. WHITFIELD.
9. E. EMMONS.
10-13. R. P. WHITFIELD.
14-20. E. EMMONS.

Figs. 21-25. R. P. WHITFIELD.
26. E. EMMONS.
27. R. P. WHITFIELD.
28-35. E. EMMONS.

PLATE IVh.

Figs. 1. R. P. WHITFIELD.
2, 3. E. EMMONS.
4, 5. R. P. WHITFIELD.
6-8. E. EMMONS.
9-11. R. P. WHITFIELD.
12-14. E. EMMONS.
15, 16. R. P. WHITFIELD.
17. E. EMMONS.

Figs. 18. G. B. SIMPSON.
19, 20. E. EMMONS.
21, 22. R. P. WHITFIELD.
23-25. E. EMMONS.
26. R. P. WHITFIELD.
27-33. E. EMMONS.
34, 35. R. P. WHITFIELD.

PLATE IVi.

Figs. 1-4. E. EMMONS.
5. R. P. WHITFIELD.
6.
7-9. E. EMMONS.
10.
11-16. E. EMMONS.
17-19. R. P. WHITFIELD.
20. G. B. SIMPSON.

Figs. 21-23. E. EMMONS.
24-26. R. P. WHITFIELD.
27-30. E. EMMONS.
31-32. R. P. WHITFIELD.
33-35. E. EMMONS.
36. R. P. WHITFIELD.
37. E. EMMONS.

PLATE IVk.

Figs. 1. E. EMMONS.
2, 3. Copies.

Figs. 4-22. E. EMMONS.
23, 24. Copies.

LIST OF SECTIONS OF THE SHELLS OF GENERA AND SPECIES OF BRACHIOPODA PREPARED FOR THE STUDY OF THE MICROSCOPIC STRUCTURE.

The preparation of these sections was begun many years since, and some examples were illustrated in the report of 1883.

The cutting machinery devised and constructed under my direction many years since, has not been in my control for several years past, and therefore comparatively little progress has been made in this work. The list now numbers over 500 sections, and we have material on hand for making a considerable increase in the number here stated. Instead of making this study of microscopic structure a part of the current volume, I have concluded to defer the work till some future time when it may be taken up as a special study.

LIST OF MICROSCOPIC SECTIONS OF BRACHIOPODA.

DECEMBER 1, 1890.

	Number of sections.		Number of sections.
Lingula punctata	2	Orthis elegantula	11
densa	2	emacerata	3
Lingulepis pinniformis	2	subæquata	4
Orbiculoidea Conradi	1	perveta	5
media	5	borealis	2
Schizotreta conica	8	subcarinata	3
Crania Hamiltoniæ	1	lenticularis	3
crenistria	1	superstes	1
Orthis tricenaria	3	Michelini	13
Hippolyte	1	Vanuxemi	17
pectinella	2	circulus	2
flabellula	6	Penelope	5
plicatella	5	hybrida	12
Ella	1	Livia	4
subquadrata	4	Missouriensis	1
deflecta	1	dubia	1
loricula	1	Tulliensis	7
strophomenoides	1	impressa	2
sinuata	4	Iowensis	7
occidentalis	18	multistriata	3
insculpta	6	Billingsella Laurentina	4
biforata	4	Scenidium pyramidale	4
biloba	4	Clitambonites Verneuili	1
Clytie	9	Triplecia Ortoni	1
testudinaria	13	Strophomena sulcata	2
Meeki	4	tenuis	2

	Number of sections.		Number of sections.
<i>Strophomena planoconvexa</i>	2	<i>Spirifer sculptilis</i>	2
<i>planumbona</i>	2	<i>Ambocœlia umbonata</i>	5
<i>fluctuosa</i>	1	<i>Spiriferina spinosa</i>	1
<i>Orthotetes subplana</i>	3	<i>Cyrtina Hamiltonensis</i>	9
<i>crenistrina</i>	3	<i>Syringothyris textus</i>	10
<i>prava</i>	1	<i>Athyris Roissyi</i>	1
<i>lens</i>	1	<i>congesta</i>	2
<i>umbraculum</i>	2	<i>spiriferoides</i>	9
<i>Hipparionyx proximus</i>	1	<i>Atrypa reticularis</i>	7
<i>Meekella occidentalis</i>	1	<i>aspera</i>	1
<i>Leptaena rhomboidalis</i>	18	<i>spinosa</i>	3
<i>Rafinesquina alternata</i>	9	<i>Whitfieldia Maria</i>	6
<i>Strophodonta arcuata</i>	4	<i>Meristella nasuta</i>	4
<i>ampla</i>	4	<i>Zygospira modesta</i>	1
<i>perplana</i>	14	<i>erratica</i>	1
<i>magnifica</i>	1	<i>Nucleospira pisiformis</i>	2
<i>crebristriata</i>	5	<i>concinna</i>	6
<i>demissa</i>	14	<i>Trematospira camura</i>	2
<i>junia</i>	3	<i>nobilis</i>	1
<i>nacrea</i>	3	<i>hirsuta</i>	3
<i>concava</i>	14	<i>Retzia evax</i>	4
<i>striata</i>	3	<i>Adrieni</i>	2
<i>Strophonella semifasciata</i>	4	<i>Rhynchonella capax</i>	2
<i>reversa</i>	1	<i>Sappho</i>	5
<i>Plectambonites sericea</i>	4	<i>Stricklandi</i>	2
<i>Chonetes deflecta</i>	3	<i>Linneyi</i>	2
<i>coronata</i>	11	<i>Leiorhynchus multicosta</i>	2
<i>scitula</i>	3	<i>Eatonina medialis</i>	4
<i>mucronata</i>	9	<i>Anastrophia internascens</i>	1
<i>Productus subalatus</i>	2	<i>Rhynchotrete cuneata</i>	3
<i>Spirifer fimbriatus</i>	1	<i>Pentamerus pseudogaleatus</i>	6
<i>mucronatus</i>	7	<i>Pentamerella arata</i>	1
<i>granuliferus</i>	5	<i>papilionensis</i>	2
<i>zic-zac</i>	1	<i>Stricklandinia</i> sp.	1
<i>pennatus</i>	6	<i>Amphigenia elongata</i>	1
<i>cyclopterus</i>	1	<i>Rensselaeria ovalis</i>	2
<i>macropleura</i>	4	<i>Leptocœlia imbricata</i>	1
<i>perlamellosus</i>	8	<i>Tropidoleptus carinatus</i>	12
<i>urbana</i>	1	<i>Cryptonella rectirostra</i>	5
<i>lævis</i>	3		
<i>medialis</i>	4		
<i>Hungerfordi</i>	3		
		Total species, 133; sections..	538

I communicate herewith the report of Prof. J. M. Clarke, Assistant Palaeontologist, giving special account of the additions to the collection and making some earnest appeals for means for carrying on field-work which has almost entirely ceased for more than ten years, thus leaving the Museum collections far in arrears of the present condition of our knowledge, especially of the older rocks and their contained fossils. Having so often and through many years recommended persistent and systematic field-work, in order to maintain the status and prestige of the Museum, I can only express the hope that some plan of work may be adopted when a moderate share of the Museum appropriation can be devoted to this object.

The Trustees of the Museum are to be congratulated in having secured the valuable collection of Trenton Limestone fossils from Mr. William Rust. The Museum collections have heretofore been quite too barren in the fossils of this period. In the same connection I can not help recalling our futile efforts on two previous occasions to secure collections of fossils of the Trenton Period.

I can not refrain from again calling your attention to the great need of fossils of the Cambrian system, of which we have scarcely anything worth mentioning.

I communicate herewith three papers by Prof. J. M. Clarke, one entitled a note on *CORONURA DIURUS*, Green (sp.); the second, Observations on *TERATASPIS GRANDIS*, Hall, the largest known Trilobite; the third, Notes on the GENUS *ACIDASPIS*.

These papers are interesting and important contributions to our knowledge of two very interesting genera and species of Trilobites, and since the Museum has recently come into possession of a nearly entire example of *Coronura aspectans*, the note on this species is very opportune.

In the same connection I communicate a catalogue of the American Palaeozoic Brachiopoda, prepared by my private assistant, Mr. Charles Schuchert, under my direction. This catalogue will be an important adjunct to the volume now in progress on the revision of the genera of the Palaeozoic Brachiopoda.

This catalogue is not yet finished and can not be satisfactorily completed till the publication of the volume now in press, and on that account I ask the privilege of communicating the remainder

at some time before this report shall be transmitted to the Legislature.

In conclusion I beg leave to state that of the volume of Palæontology now in press, about 250 pages are now in type. The lithography is completed to within two plates. These plates are now in the hands of the lithographer, and will be completed before the 1st of January, 1891.

The work of preparing the original drawings for the second part of the volume is progressing. We shall however soon be in want of new material, which I propose to obtain with little delay.

I hope to have an opportunity of showing to the committee on the State Museum the lithographed plates, and original drawings already prepared for the second part of volume VIII of the Paleontology of New York.

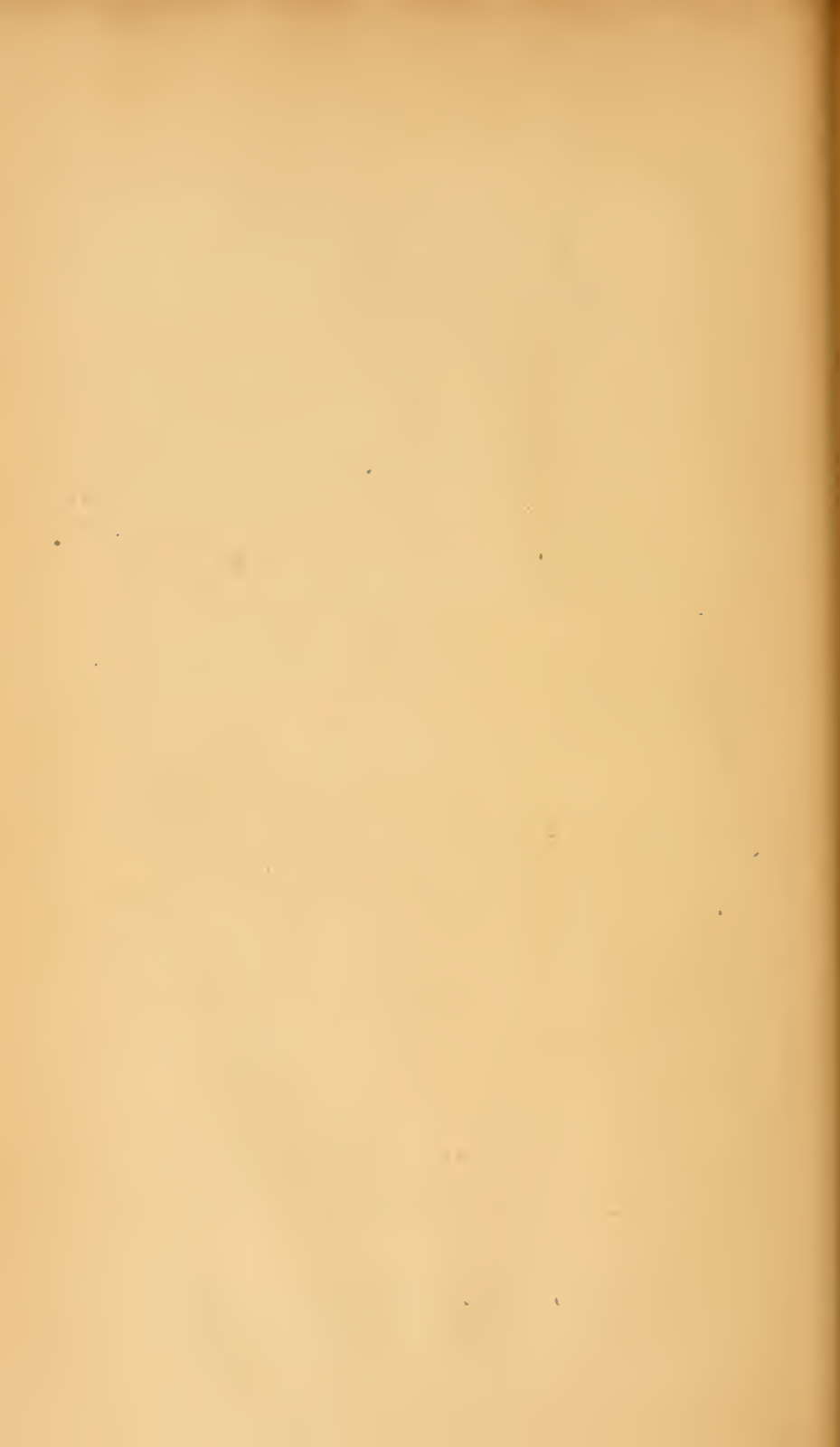
All of which is respectfully submitted by

Your obedient servant

JAMES HALL,

State Geologist.

December 1, 1890.



REPORT TO THE DIRECTOR
ON THE
Condition of the Palæontological Department
OF THE
NEW YORK STATE MUSEUM,
1890.

REPORT OF ASSISTANT PALÆONTOLOGIST.

ALBANY November 6, 1890.

JAMES HALL, LL. D., *Director* :

SIR.—The most notable addition during the past year to the Palæontological Department of the Museum, has been the acquisition of a large collection of fossils from the Black river limestone, Trenton limestone, Utica slate and Hudson river shales and sandstones from the central part of the State; a purchase from Mr. Wm. P. Rust, of Trenton Falls. This collection is especially rich in the beautiful trilobites and crinoids of the Trenton, which are now becoming rare and difficult to obtain; the gastropods and cephalopods of this formation are excellently represented. It also contains a fine series of the Utica slate fossils, with an exceptionally complete representation of the developmental stages of the trilobite *Triarthrus Becki*, fine specimens of *Cyathophycus*, graptolites, etc. As a whole this collection strengthens our series of New York fossils very materially, helping to fill the serious gap in our illustration of the earlier palæozoic faunas of the State. A few specimens only from the collection have been placed in the exhibition cases, replacing some less satisfactory examples of prominent species; it has been necessary to place the greater part of it in the drawers on the south and east tiers of cases on the Palæozoic floor of Geological Hall.

Comparatively little has been added to the collections through work in the field by members of the staff. During the month of August the Assistant Palæontologist made some collections from the Genesee and Lower Portage shales of Ontario and Yates counties, securing eleven boxes of specimens, only a part of which have been opened. Our representation of these faunas has been exceedingly meager, and though probably superior to that of any other institution, has afforded no adequate conception of their variety and composition. The material thus acquired will be helpful in completing this series, and we may expect much more substantial assistance in this direction from the services of Mr.

D. D. Luther, of Naples, N. Y., with whom some negotiations have been made.

With the aid of Mr. Charles Schuchert, the Assistant Palæontologist has also made some collections from the Oriskany sandstone on Becraft's Mountain, near Hudson.

Mr. Jacob Van Deloo has collected from the Potsdam sandstone at the Ausable Chasm, and Chazy limestone at Keeseville.

The Museum is under especial obligations to Sir William Dawson, of Montreal, for the donation of a series of specimens illustrating the remarkable fossil sponges described by him from the Levis formation. In addition to these the same gentleman has generously contributed interesting specimens of brachiopods and other fossils, as seen in the accompanying list.

The need of more extensive and systematic work in the collection of fossils from faunas in our own State is poignantly felt. Of the rich primordial faunas our representation is meager in the extreme. Private individuals and representatives of the U. S. Geological Survey have carried on extensive operations among the early rocks of the State securing materials which it may not be possible to duplicate for years to come. From lack of means the State Museum has been unable to enter into competition with these collectors, or to make any serious effort to secure for itself a series of these most important fossils. The study of these primordial faunas as developed in our own State has in other places awakened the greatest interest and enthusiasm, and we do ourselves and students of geology throughout the State of New York an injustice in not providing, in the State Museum, the means of illustrating them. The time of the Assistant Palæontologist is given almost exclusively to the preparation of the Palæontology of New York. Field-work can not be undertaken by him at present without equivalent neglect of his more immediate duties. There is no other member of the staff who can be called upon for such services without similar neglect in other directions. The needs of this department urgently call for the services of an intelligent and muscular man, who could be kept in the field during the months suitable for such work, and be busied with the more mechanical work of conservator for the remainder of the year. Such a man might be obtained at a moderate salary, and his services be equally useful to the departments of Geology, Mineralogy and Palæontology.

The work of preparing for exhibition the fossil crustacea of the palæozoic rocks has been initiated, and will progress as rapidly as the other duties of the Assistant will permit. No essential changes have been made in the arrangement of the fossils on either the second or third floors of the Geological Hall. The new material coming in to the department is mostly received and stored in drawers at the State Hall.

Respectfully submitted

J. M. CLARKE,

Assistant Palæontologist.

List of Accessions to the Department of Palæontology.

BY PURCHASE.

	Specimens.
From William P. Rust, Trenton Falls, N. Y. :	
Black River limestone, Alder Creek, near Boonville, N. Y. (Museum ticket, 1161).....	260
Trenton limestone, Trenton Falls (Museum ticket, 1164)	891
Trenton shale, near Holland Patent (Museum ticket, 1165)..	182
Utica slate, Holland Patent (Museum ticket, 1231)	770
Hudson River shales, near Rome (Museum ticket, 1232)	334
Hudson River sandstone, erratic blocks (Museum ticket, 1233)	341
Total	2,785

From A. L. Arey, Rochester, N. Y. :

	Specimens.
<i>Dalmanites aspectans</i> , Conrad. An entire individual from the Corniferous limestone at Lime Rock, N. Y.	1
From Mr. Tubbs, New York, N. Y. :	
<i>Dalmanites myrmecophorus</i> , Green. A large pygidium figured in Palæontology of New York, vol. vii, pl. xiv, fig. 1	1

BY EXCHANGE.

From A. L. Arey, Rochester, N. Y. :	
<i>Phacops trisulcatus</i> , Hall. Clinton group, Rochester	1
<i>Bronteus occasus</i> , Winch. and Marcy. Niagara group, Rochester	1
<i>Lichas</i> , sp. indet. Niagara group, Rochester	1
From F. A. Blair :	
Lot of fossils from the Choteau limestone of Missouri.	
From C. E. Beecher, New Haven, Conn. :	
<i>Tornoceras uniangularæ</i> , Conrad. Hamilton group, Wende Station	3
From Emmett Brown, Belfast, N. Y. :	
Fossils from Spergen Hill, Indiana, as follows:	
<i>Rhynchonella Grosvenori</i>	12
<i>Terebratulula formosa</i>	6

Specimens.

<i>Terebratula turgida</i>	6
<i>Athyris trinuclea</i>	6
<i>Eumetria Verneuiliana</i>	6
<i>Rhynchonella mutata</i>	4
<i>Orthis dubia</i>	3
<i>Pentremites conoideus</i>	6
<i>Cypricardella oblonga</i>	7
<i>Nucula Shumardana</i>	8
<i>Leptopsis Levettii</i>	1
<i>Athyris trinucleus</i>	6
<i>Zaphrentis spinulifera</i>	5
<i>Productus Indianensis</i>	6
<i>Productus tenuicostatus</i>	5
<i>Productus biseriatus</i>	3
<i>Bellerophon sublaevis</i>	6
<i>Endothyra Baileyi</i>	40
<i>Leperditia carbonaria</i>	20
<i>Murchisonia vermicula</i>	10
<i>Murchisonia insculpta</i>	6
<i>Murchisonia attenuata</i>	8
<i>Holopea Proutana</i>	6
<i>Cyclonema Leavenworthanum</i>	6
Lamellibranchs (undetermined)	6
Trilobite tail	1

BY COLLECTION.

By J. M. Clarke :

Fossils from the Genesee shales and limestone, and Lower Portage (Naples) shales and sandstones. Ontario and Yates counties. Eleven boxes, one slab.

By J. M. Clarke and Charles Schuchert :

Fossils from the Oriskany sandstone, Becraft's Mountain, approx..... 450

By Jacob Van Deloo :

Fossils from the Potsdam sandstone, Ausable Chasm (Museum ticket, 1096)..... 31

Crustacean (?) tracks from the Potsdam sandstone, Keeseville. Two slabs.

Fossils from the Chazy limestone, Keeseville (Museum ticket, 1113, 1114) 132

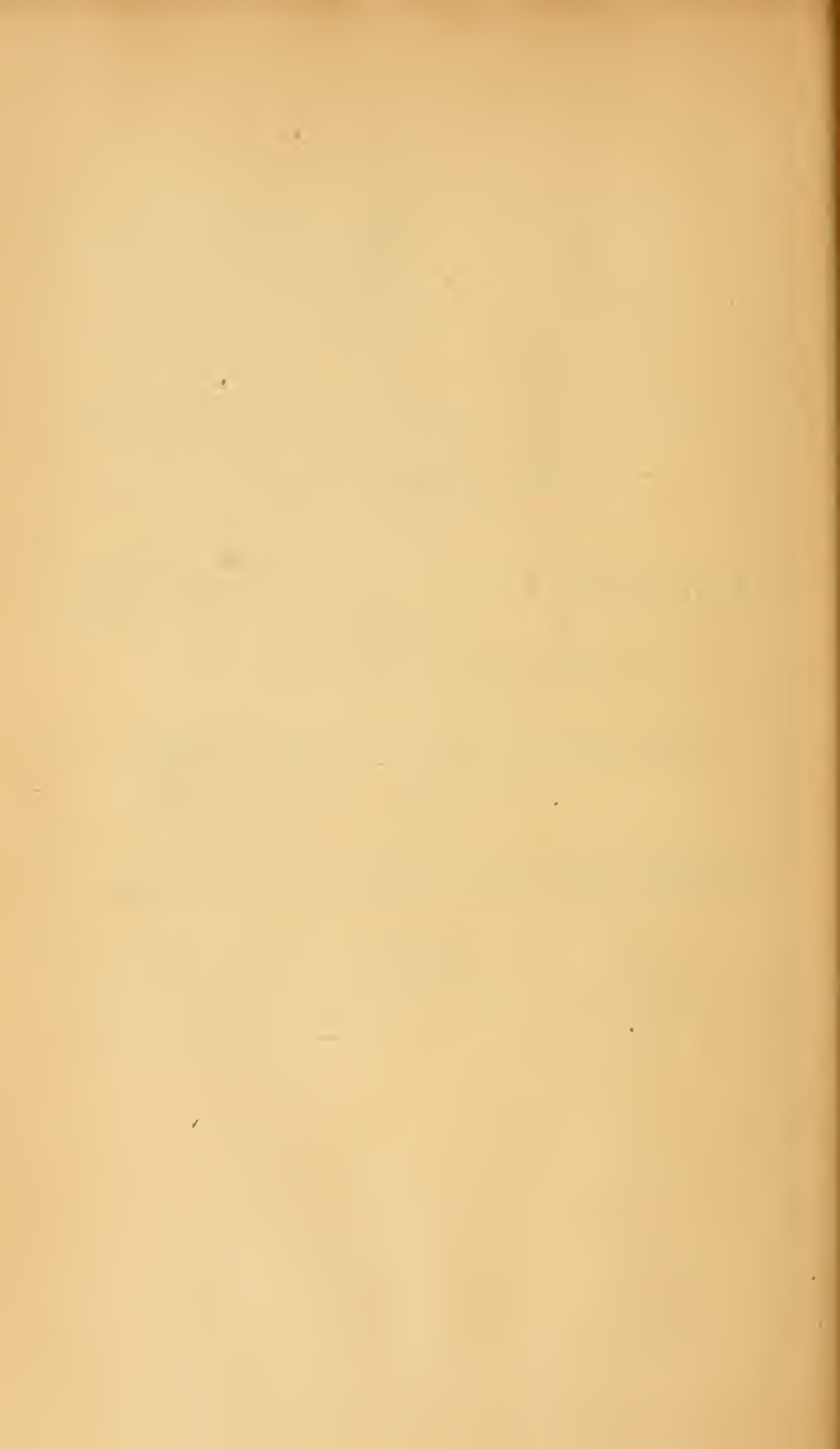
BY DONATION.

From Sir William Dawson, Montreal :		Specimens.
<i>Orthisina Verneuli</i> , Eichwald. Anticosti.....		4
<i>Hindella umbonata</i> , Billings. Anticosti		5
<i>Orthis porcata</i> , Billings. Anticosti		4
<i>Orthis hybrida</i> , Sowerby. Anticosti		2
<i>Atrypa marginalis</i> , Dalman. Anticosti		5
<i>Orthis</i> (?) <i>Laurentina</i> , Billings. Anticosti		5
<i>Meristina didyma</i> (?), Dalman. Picton		11
<i>Lingulepis pinniformis</i> , Owen. Beverly.....		1
<i>Linnarssonina pretiosa</i> , Billings. Little Metis.		7
<i>Bolboporites Americanus</i> , Billings. Chazy, Montreal.....		7
<i>Blastoidocrinus carcharidens</i> , Billings. Montreal.....		1
<i>Murchisonia Anna</i> , Billings. Calciferous, Montreal.....		1
<i>Monticulipora</i> . Chazy, Montreal.....		1
<i>Bythotrephis pergracilis</i> , Dawson. Little Metis		1
<i>Protospongia monema</i> , Dawson. Little Metis		2
<i>P. delicatula</i> , Dawson. Little Metis		1
<i>P. coronata</i> , Dawson. Little Metis		2
<i>P. cyathiformis</i> , Dawson. Little Metis ?.....		1
<i>Acanthodictya hispida</i> , Dawson. Little Metis		1
<i>Cyathospongia tetranema</i> , Dawson. Little Metis.....		2
<i>C. Quebecensis</i> , Dawson. Little Metis		1
<i>Hyalostelia Metissica</i> , Dawson. Little Metis		4

From E. B. Knapp, Skaneateles :

<i>Dalmanites Boothi</i> , Green (in pyrite nodule). Hamilton group, Livingston county	1
<i>Platystoma cochleatum</i> , Hall. Corniferous limestone, Onon- daga Reservation	3
<i>Asaphus megistus</i> , Locke. (Plaster cast, showing under sur- face and appendages.)	

CONTINUATION
OF
DESCRIPTIONS OF BRYOZOA,
NOT PRINTED IN VOLUME VI,
PALÆONTOLOGY OF NEW YORK,
FOR THE
REPORT OF THE STATE GEOLOGIST,
1890.



DESCRIPTIONS OF BRYOZOA.

Paleschara pertenuis.

- Paleschara pertenuis.* Hall, Trans. Albany Institute, vol. x, p. 179, 1881.
" " " Report of State Geologist for 1883, p. 7, 1884.
" " " Palæontology of New York, vol. vi, p. 237.
Not figured, 1887.

* * * * *
Zoarium consisting of extremely thin foliaceous expansions incrusting other objects; all the specimens are incrusting cyathophylloid corals; greatest thickness observed, .20 mm. Cells sometimes polygonal, but usually circular or oval, walls thick; diameter .33 mm., either irregularly disposed, or forming intersecting rows. Interstitial cellules minute, rarely a cell is entirely surrounded by them; sometimes there are only one or two for each cell, and at other times for a considerable space the cells are in contact, without intermediate cellules. Surface marked by maculæ or very slightly elevated monticules, the centers of which are distant about 3.50 mm.; a space 1.50 mm. in diameter being occupied by cells larger than the others, and having a diameter of about .50 mm.

This species may be distinguished from others of this formation by the more nearly circular or oval cells, and their crowded or confused appearance.

Formation and locality.—Hamilton group, Darien Centre, Erie county, N. Y.

Paleschara intercella.

- Paleschara intercella.* Hall. Trans. Albany Institute, vol. x, p. 179, 1881.
" " " Report of State Geologist for 1883, p. 5, 1884.
" " " Palæontology of New York, vol. vi, p. 237.
Not figured 1887.

* * * * *
Zoarium consisting of extremely thin foliaceous expansions incrusting other objects, most frequently cyathophylloid corals. Cells polygonal, .33 mm. in diameter, in contact, sometimes irregu-

larly disposed ; at other times forming intersecting rows, the surface of the frond presenting a somewhat regularly reticulated appearance. Interstitial cells about equal in number to the larger ones, diameter .8 mm. usually quadrangular, square or oblong, the shape and size varying according to the width of the adjacent sides of the large cells. Surface marked by broad, slightly elevated monticules, the centers of which are distant about 3.50 mm. ; and have a space about 1.50 mm. in diameter occupied by larger cells of .45 mm. in diameter. The summits of the cell walls have frequently short triangular spinules, usually occurring at the angles, but sometimes on other portions of the walls.

This species closely resembles *P. reticulata*, but the cell walls are thinner, the cells are smaller, and the interstitial cells are much more frequent ; from *P. pertenuis* it is distinguished by the thinner cell walls, the more closely disposed maculæ and the more decidedly polygonal form of the cells ; from *P. varicella* by the smaller cells, more closely disposed monticules, and the presence of interstitial cells ; from *P. amplexans* by the larger size of the cells ; from *P. incrustans* of the Lower Helderberg group, by the thinner cell walls, the smaller cells, more numerous interstitial cells, with larger cells on the monticules.

Formation and locality.—Hamilton group, York, Livingston county, N. Y.

Paleschara reticulata.

Paleschara reticulata. Hall, Trans. Albany Institute, vol. x, p. 179, 1881.

" " " Report of State Geologist for 1883, p. 6, 1884.

" " " Palæontology of New York, vol. vi, p. 237.

Not figured, 1887.

* * * * *

Zoarium, consisting of extremely thin foliaceous expansions incrusting other bodies, greatest thickness observed .33 mm. Cells usually pentagonal or hexagonal, sometimes quadrangular, diameter .35 mm., in contact ; usually irregularly disposed, but sometimes arranged in undulating intersecting rows, and generally, when so disposed, the cells are quadrangular, giving to the surface a somewhat regularly reticulate appearance. Interstitial cells minute and on some of the fronds very infrequent. Surface marked by maculæ, the centers of which are distant 4 or 5 mm., with a central space 1.50 mm. in diameter, occupied by larger

cells, which have a diameter of .45 or .50 mm. When the surface is well preserved the angles of the cell walls are ornamented with small spinules.

Sometimes there are remains of very fragile projections on the margins of the aperture, which are probably the remains of a lip, which extended partially over the aperture, as in the recent *Flustra*. This feature if complete would give to the frond a very different appearance from that which it now presents.

This species may be distinguished from *P. intercella* by its somewhat larger cell apertures and more distant monticules; from *P. variacella* by the presence of interstitial cells, and the much less variation in size between the ordinary cells and those on the monticules; from *P. pertenuis* by the more decidedly polygonal cells, and the less crowded or confused appearance of the surface; from *P. amplexans* by the larger cell apertures; from *P. incrustans* of the Lower Helderberg group, by the more frequent interstitial cells and the variation in size between the ordinary cells and those on the monticules.

Formation and locality.—Hamilton group, York, Livingston county, N. Y.

Paleschara variacella.

- Paleschara variacella*, Hall. Trans. Albany Institute, vol. x, p. 179, 1881.
 “ “ “ Report of State Geologist for 1883, p. 7, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 237.
 Not figured, 1887.

* * * * *

Zoarium consisting of extremely thin foliaceous expansions incrusting other bodies, most frequently Cyathophylloid corals; greatest thickness observed .50 mm. Cells polygonal, from quadrangular to hexagonal, diameter about .28 mm., sometimes a little longer than wide; in contact; usually irregularly disposed but sometimes in intersecting rows, the frond presenting a somewhat regular reticulated appearance. There are no interstitial cells on the specimens observed. Surface marked by slightly elevated monticules, the centers of which are distant about 4 mm. with a space 1.50 mm. in diameter occupied by larger cells which have a diameter of from .45 to .60 mm. The angles of the cell walls are frequently ornamented by strong spinules.

This species may be distinguished from *P. intercella* by the smaller ordinary cells, larger cells on monticules and the absence of interstitial cells; from *P. reticulata* by the absence of interstitial cells; from *P. pertenuis* by the more decidedly angular cell apertures and the absence of interstitial cells; from *P. amplectens* by the larger cells; from *P. incrustans* of the Lower Helderberg group by the cells on the monticules being larger than the others.

Formation and locality.—Hamilton group, York, Livingston county, N. Y.

Paleschara amplectens.

Paleschara amplectens, Hall. Trans. Albany Institute, vol. x, p. 179, 1881.
 " " " Report of State Geologist for 1883, p. 7, 1884.
 " " " Palaeontology of New York, vol. vi, p. 237.
 Not figured, 1887.

* * * * *

Zoarium consisting of extremely thin foliaceous expansions incrusting other fossil bodies, especially crinoid columns; greatest thickness observed less than .25 mm. Cells polygonal, varying from quadrangular to hexagonal, in contact; diameter .20 mm., sometimes irregularly disposed; at other times forming oblique intersecting rows, giving to the surface a regularly reticulated appearance; the margins of the cell walls have frequently minute nodes or spinules at the angles; sometimes they occur on other portions of the margins. The surface is not marked by maculae or monticules; the cells being of uniform size.

This species may be distinguished from any other of this geological formation by the smaller size of the cells, and the absence of maculae or monticules.

Formation and locality.—Hamilton group, shore of Seneca lake, N. Y.

Stictopora rectalineae.

Stictopora rectalineae, Hall. Palaeontology of New York, vol. vi, p. 245, pl. lxiii, fig. 23, 1887.

* * * * *

This species in its general appearance most nearly resembles *S. crescens* and *S. rigida* of the Upper Helderberg group; from the former it may be distinguished by the smaller, more distant

cell apertures, the greater number of ranges of cell apertures, the striated convex space between the ranges of apertures, and the smooth noncelluliferous marginal space; from *S. rigida* it may be distinguished by the wider branches, greater number of ranges of apertures, the smaller, more distant and more decidedly oval cell apertures, and the broader, convex space between the ranges of apertures; in that species the ranges of apertures are separated by strong angular, striated ridges, not wider than the cell apertures; from *S. crenulata* it may be distinguished by its wider, more rigid branches, greater number of ranges of oval apertures, and convex interspace; from *S. subrigida* and *S. angularis*, by its wider branches, oval, not pustulose cell apertures, and the absence of strong ridges separating the ranges of apertures; from *S. recta* by the wider frond, greater number of ranges of apertures, and the absence of strong longitudinal, granulose ridges; from *S. incisurata*, by the parallel margins of the frond and ranges of apertures, the smaller apertures and the convex, striated interapertural space; from *S. trilineata* and *S. tumulosa* by the greater number of ranges of smaller apertures and the convex or subangular, finely striated interspaces.

Formation and locality.—Hamilton group, West Williams, Ontario, Canada.

Stictopora tumulosa.

Stictopora tumulosa, Hall. Palæontology of New York, vol. vi, p. 246, pl. lxi, figs. 18-22, 1887.

* * * * *

This species in its general appearance and mode of branching most nearly resembles *S. trilineata*, but the frond is thinner, more flattened; the apertures are smaller, more decidedly circular, pustuliform, more distant; the striations are fewer and less prominent; from *S. incisurata* it may be distinguished by the parallel margins of the frond, smaller, circular, pustuliform and more distant cell apertures, the finer, more numerous striations; from *S. sinuosa* it may be distinguished by its somewhat wider branches, smaller, circular, more distant cell apertures, finer and generally continuous striations. *S. angularis* and *S. recta* have circular, pustuliform cell apertures, but in those species the ranges of apertures are separated by very prominent, strong

ridges; from the other species, at present known, it may be distinguished by minute, circular pustuliform cell apertures.

Formation and locality.—Hamilton group, Moscow, Livingston county, N. Y.

Stictopora striata.

Stictopora striata, Hall. Palæontology of New York, vol. vi, p. 246, pl. lxiii, fig. 22, 1887.

* * * * *

This species most closely resembles some forms of *S. tumulosa*, but the apertures are larger, not so decidedly circular, much less pustuliform; the peristomes are stronger, and the striæ are shorter, broader, and much more numerous; from *S. trilineata* it may be distinguished by the more nearly circular, more oblique, less regularly disposed cell apertures, and the short tortuous striæ; from *S. interstriata* by its more nearly circular cell apertures, the stronger peristomes, the absence of spiniform projections from the interior of the cell tube, the fewer, stronger and much more tortuous striations; from *S. sinuosa* by the broader frond, the more frequent cell apertures, more prominent peristomes, the slighter and much more frequent longitudinal striations; from *S. granifera* by the nearly parallel margins of the frond, much fewer striations, and the absence of nodes on the peristomes and striations; from *S. incisurata* by its numerous striations; from any other species at present known from the Lower and Upper Helderberg and Hamilton groups, by the numerous, short, tortuous striations.

Formation and locality.—Hamilton group, Ontario county, N. Y.

Stictopora sinuosa.

Stictopora sinuosa, Hall. Trans. Albany Institute, vol. x, p. 190, 1881.
 " " " Report of State Geologist for 1883, p. 42, 1884.
 " " " Palæontology of New York, vol. vi, p. 247, pl. lxi, fig. 17, 1887.

* * * * *

This species may be distinguished from *S. incisurata* by its narrower form, more rigid appearance, and the sinuous interrupted striations or ridges; from *S. trilineata* by the more rigid form, broadly oval oblique cell apertures, and the sinuous, interrupted ridges or striations; from *S. tumulosa* by the broadly

oval, slightly oblique cell apertures, which never have the pustuliform appearance characteristic of that species; from *S. interstriata* it may be distinguished by the more broadly oval, slightly oblique cell apertures, the strong sinuous striations, and the absence of spinulose projections from the interior of the cell aperture; from the other species at present known in the Hamilton and Upper Helderberg groups it may be distinguished by the narrow, somewhat rigid form, and strong, sinuous, interrupted ridges between the apertures.

Formation and locality.—Hamilton group, south of Auburn, shore of Cayuga lake, N. Y.

Stictopora ovata.

Stictopora ovata, Hall. Palæontology of New York, vol. vi, p. 248, pl. lxiii, fig. 24, 1887.

* * * * *

This species most closely resembles *S. incrassata*, but may be distinguished as follows: The cell apertures are more broadly oval, the larger end of the ovate aperture is toward the base, the peristome is unequally elevated, the posterior portion being the most prominent and oblique, the cell apertures are more distant longitudinally and more closely disposed transversely, and are smaller and more broadly ovate than those of that species; from the other species, at present known, from the Lower and Upper Helderberg and Hamilton groups, it may be distinguished by the large size and great thickness of the frond, the large ovate cell apertures and the sinuous angular striation between the ranges of apertures.

Formation and locality.—Hamilton group, near the foot of Canandaigua lake, N. Y.

Stictopora incrassata.

Stictopora incrassata, Hall. Trans. Albany Institute, vol. x, p. 190, 1881.
 “ “ “ Report of State Geologist, for 1883, p. 47, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 249, pl. lxii, figs. 1-6, 1887.

* * * * *

This species occurs in association with *Semiopora bistigmata*, and in its manner of growth closely resembles that species, but may easily be distinguished by its more robust form and the absence

of strong longitudinal ridges, and interapertural pits; its size and thickness will easily distinguish it from any other species of the Lower and Upper Helderberg and Hamilton groups, at present known, with the exception of *S. ovata*, and it may be distinguished from that species by the more decidedly ovate form of the apertures and in the posterior portion of the aperture being the narrower, the equally elevated peristomes and the wider space between the rows of apertures.

Formation and locality.—Hamilton group, West Williams, Province of Ontario, Canada.

Stictopora limata.

Stictopora limata, Hall. Palaeontology of New York, vol. vi, p. 250, pl. lxi, figs. 14-16, 1887.

* * * * *

This species has a slight resemblance to the ordinary forms of *S. incisurata*; from those forms having broad longitudinal ridges, it may be distinguished by the more slender frond, its more rigid appearance, comparatively more infrequent bifurcations, smaller cell apertures, and their more regular disposition in parallel, longitudinal rows; from *S. subrigida* it may be distinguished by the somewhat wider branches, larger oval cell apertures, which are not pustuliform. The cell apertures of that species have a diameter of about .10 mm.; are circular and pustuliform; very nearly the same features will distinguish it from *S. angularis*. From *S. recta* it may be distinguished by the somewhat wider branches, smaller and more distant cell apertures, fewer ranges of apertures on a branch; much wider longitudinal ridges, and the absence of nodes on the ridges; from *S. bifurcata* by the more distant bifurcations, fewer ranges of apertures on a branch, and much wider longitudinal ridges, and the absence of minute nodes; from *Ptilodictya parallela* by the smaller cell apertures and the much stronger longitudinal ridges; from *Stictopora rigida* and *S. crescens* of the Upper Helderberg group by the much smaller and comparatively more distant cell apertures.

Formation and locality.—Hamilton group, Darien Centre, N. Y.

Stictopora subrigida.

- Stictopora subrigida*, Hall. Trans. Albany Institute, vol. x, p. 190, 1881.
 " " " Report of State Geologist for 1883, p. 43, 1884.
 " " " Palæontology of New York, vol. vi, p. 251, pl.
 . lx, fig. 21, 1887.

* * * * *

This species very closely resembles *S. angularis*, but the bifurcations occur at much greater intervals, the longitudinal ridges are much more prominent, and the cell apertures somewhat smaller; it also very closely resembles *S. limata*, that species having the bifurcations distant and the cell apertures disposed in parallel rows separated by prominent ridges, whose width is greater than that of the apertures, but its cell apertures are oval and are separated by only a little more than the diameter of an aperture; from *S. rigida* of the Upper Helderberg group it is distinguished by its narrower form, smaller, more decidedly circular and more distant cell apertures, and the broad, rounded, separating ridges; in that species it is narrower and when not worn is sharply angular; from *S. crescens*, by its narrower form, smaller, circular cell apertures, and the broader, more prominent longitudinal ridges; from *S. incisurata*, by the narrower form, parallel margins of the branches and broad ridges separating the ranges of apertures

Formation and localities.—Hamilton group, near Middleburg, Schoharie county, and railroad cutting, two and a half miles east of Alden Station, Erie county, N. Y.

Stictopora crenulata.

- Stictopora crenulata*, Hall. Report of State Geologist for 1883, p. 44, 1884.
 " " Palæontology of New York, vol. vi, p. 252,
 pl. lx, fig. 22. 1887.

* * * * *

This species in the comparatively slight, angular striations between the rows of apertures resembles *S. trilineata* and *S. tumulosa*; it may be distinguished from the former by the smaller, circular cell apertures, the unequally elevated peristomes, the fewer rows of apertures on a branch, the smooth non-celluliferous marginal space; from *S. tumulosa* it may be distinguished by the

narrower form of the frond, the apertures not pustuliform and much less conspicuous, the very oblique cell apertures of the marginal rows, and the narrow non-celluliferous marginal space; from *S. subrigida*, *S. angularis*, *S. recta*, *S. bifurcata*, and *S. rigida* and *S. crescens* of the Upper Helderberg group, it may be distinguished by the more numerous and much finer longitudinal striations; from *S. incisurata* it is distinguished by the narrower form of the frond, more nearly parallel margins, smaller and more indistinct cell apertures, finer and more numerous striations.

Formation and locality.—Hamilton group, near Alden, Erie county, N. Y.

Stictopora angularis.

Stictopora angularis, Hall. Palæontology of New York, vol. vi, p. 252, pl. lxi, fig. 23, 1887.

* * * * *

This species most closely resembles *S. subrigida*, but the frond is more decidedly subangular along the middle, the cell apertures are more pustuliform, the longitudinal ridges are not so prominent, the frond is wider, and the bifurcations are more frequent; from *S. recta* it may be distinguished by its somewhat wider branches, smaller more decidedly circular, and more prominently pustuliform cell apertures, wider longitudinal ridges, and absence of nodes or granules on the ridges; from *S. trilineata*, it is distinguished by its somewhat narrower form, more frequent bifurcations, smaller, pustuliform apertures, and the prominent longitudinal ridges; it resembles *S. tumulosa* in having pustuliform cell apertures, but the apertures are smaller, and the ranges of apertures are separated by prominent ridges; in that species the striations are more numerous, very slender and slightly elevated; from *S. rigida* and *S. crescens* it is distinguished by its smaller, circular, more distant, pustuliform cell apertures; from *S. crenulata* by the prominent ridges.

Formation and locality.—Hamilton group, four miles south of LeRoy, Genesee county, N. Y.

Stictopora recta.

Stictopora recta, Hall. Palæontology of New York, vol. vi, p. 253.
Not figured, 1887.

* * * * *

This species most closely resembles *S. bifurcata*, but may be distinguished by the much less frequent bifurcations, the parallel margins of the branches, the less variation in size between the marginal and ordinary apertures, less prominent and more irregularly disposed granules on the longitudinal ridges; from *S. palmipes* by the different mode of growth, the absence of lateral branches, narrow non-celluliferous marginal space, smaller cell apertures, and less prominent longitudinal ridges; from *S. angularis* it may be distinguished by the somewhat narrower, more regularly convex frond, smaller, more decidedly oval cell apertures, which are not pustuliform, and the narrower, granulose ridges. The cell apertures of *S. angularis* are circular and pustuliform, and the longitudinal ridges are smooth; nearly the same features will distinguish it from *S. subrigida*; from *S. incisurata*, it may be distinguished by its narrower, more rigid frond, smaller and more closely disposed cell apertures, and comparatively more prominent longitudinal, granulose ridges; from *S. trilineata* and *S. tumulosa* by the narrower frond, and prominent, longitudinal ridges; from *Ptilodictya parallela* by the different mode of growth, narrower form, smaller cell apertures and more prominent ridges; from *S. rigida* and *S. crescens* of the Upper Helderberg group it is distinguished by the narrower frond, smaller cell apertures and comparatively more prominent longitudinal ridges.

Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

Stictopora bifurcata.

Stictopora bifurcata, Hall. Palæontology of New York, vol. vi, p. 254, pl. lxiii, fig. 17, 1887.

* * * * *

This species most closely resembles *S. palmipes*, but may be distinguished by the more nearly parallel margins of the frond, the absence of lateral branches, the smaller cell apertures, the somewhat more slender, longitudinal ridges and the less prominent

nodes ; it has also a very close resemblance to *S. recta*, but may be distinguished by its less rigid appearance, much more frequent bifurcations, and greater variation in size between the ordinary cell apertures and those of the marginal rows ; from *P. tumulosa* and *S. subrigida* it may be distinguished by its more frequent bifurcations, the oval cell apertures and the narrower ridges ; from *Ptilodictya parallela* by the narrower frond, more frequent bifurcations, smaller, more elongate-oval cell apertures, more prominent and more closely arranged longitudinal ridges ; from *S. incisurata* by its more frequent bifurcations, smaller and generally more elongate-oval cell apertures, and the nodose, comparatively stronger longitudinal ridges ; from *S. sinuosa* by the straight continuous ridges ; from *S. trilineata* and *S. tumulosa* by the narrower form, more frequent bifurcations and much more prominent longitudinal ridges ; from *S. rigida* and *S. crescens* of the Upper Helderberg group it is distinguished by the more frequent bifurcations, smaller cell apertures and comparatively stronger ridges ; from *S. fruticosa* and *S. ovatifora* by the much smaller cell apertures.

Formation and locality.—Hamilton group, near Muttonville, Bristol township, Ontario county, N. Y.

Stictopora palmipes.

- Stictopora palmipes*, Hall. Trans. Albany Institute, vol. x, p. 189, 1881.
 “ “ “ Report of State Geologist for 1883, p. 41, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 255, pl.
 lx, figs. 19, 20, 1887.

* * * * *

This species resembles *S. bifurcata* in having oval cell apertures, arranged in regular longitudinal rows, separated by prominent, nodose ridges ; but it differs from that species in having lateral branches, and in the non-celluliferous margin occupying the entire space between them. *S. recta* and *S. angularis* have prominent longitudinal ridges much elevated above the peristomes, but the branches of those species are regularly bifurcating, are narrow, rigid in appearance, and the margins are essentially parallel. From all other species, at present known from the Lower and Upper Helderberg and Hamilton groups, this one may be dis-

tinguished by the peculiar mode of branching, and in having the non-celluliferous margin bordering the entire frond.

Formation and localities.—Shales of the Hamilton group, West Hamburg, Erie county; Pavilion, Genesee county, and near Canandaigua lake, Ontario county, N. Y.

Stictopora granifera.

Stictopora granifera, Hall. Trans. Albany Institute, vol. x, p. 191, 1881.
 “ “ “ Report of State Geologist for 1883, p. 45, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 257, pl. lxi, figs. 1-6, 1887.

* * * * *

This species may be distinguished from *S. interstriata* by the difference in manner of growth, the branches being much widened before bifurcating, while in that species the margins of the frond are parallel, the peristomes and interapertural striæ are nearly equal in strength and are granulose; the cell apertures are very indistinct, while in *S. interstriata* they are conspicuous; when a frond of this species is weathered so that the granules are nearly or quite obsolete the resemblance to that species is much greater. From *S. divergens* it may be distinguished by the size of the frond, the width of that species being only from 1 to 1.50 mm., the comparatively greater expansion before bifurcating, the larger cell apertures and the somewhat more numerous striations; from *S. sinuosa* it may be distinguished by the great expansion of the branches before bifurcating, the more lax appearance of the frond, the more elongate oval apertures, more numerous and straighter striations, and the granules on the peristomes and striæ.

Formation and localities.—Hamilton group, near Pavilion village, Genesee county, and Muttonville, North Bristol township, Ontario county, N. Y.

Stictopora divergens.

Stictopora divergens, Hall. Palæontology of New York, vol. vi, p. 257, pl. lxiii, figs. 18, 19, 1887.

* * * * *

This species most closely resembles *S. granifera*, but the fronds are narrower, the margins of the branches are more nearly parallel, and the branches increase but little in width before bifurcating;

the cell apertures are a little smaller, and the nodes on the peristomes and longitudinal striæ are much finer, the striations are fewer in number and a transverse section of the branch is more nearly oval. The appearance of the frond and manner of growth is very similar to that of *S. rhomboidea* of the Upper Helderberg, but the cell apertures are very different; in that species they are much smaller, and the peristomes are very thin and scarcely elevated, the longitudinal striations are continuous, sinuous or zigzag, usually coalescing between the cell apertures and inclosing a rhomboidal vestibular area; from *S. interstriata* this species may be distinguished by the stronger peristomes, absence of spiniform projections from the interior of the cell wall, the much fewer and stronger longitudinal striations, and the granules of the peristomes and striations; from *S. permarginata* by the longitudinal striations, that species having the interapertural space smooth.

Formation and locality.—Hamilton group, Darien Centre, N. Y.

Stictopora permarginata.

<i>Stictopora permarginata</i> , Hall.	Trans. Albany Institute, vol. x, p. 191, 1851.
“ “ “	Report of State Geologist for 1883, p. 46, 1884.
“ “ “	Palæontology of New York, vol. vi, p. 258, pl. xiii, fig. 16, 1887.

* * * * *

This species most closely resembles *S. granifera*, but may be distinguished from that species; the frond is narrower and more rigid in appearance, the branches do not widen before bifurcating, the cell apertures are somewhat larger, much more closely disposed, the peristomes are stronger, the striations are stronger and much more infrequent. It very closely resembles *S. divergens*, but may be distinguished by the wider fronds more infrequent bifurcations, the parallel margins, more closely disposed cell apertures and the stronger nodes on the peristomes and striations.

Formation and locality.—Hamilton group, West Hamburg, Erie county, N. Y.

Stictopora interstriata.

Stictopora interstriata, Hall. Trans. Albany Institute, vol. x, p. 191, 1881.
 " " " Report of State Geologist for 1883, p. 45, 1884.
 " " " Palaeontology of New York, vol. vi, p. 259, pl.
 lxii, figs. 7-12, 1887.

* * * * *

This species will be easily distinguished from *S. incisurata* by the narrow, somewhat rigid form, with essentially parallel margins, and the numerous interapertural striations; from *S. granifera* it may be distinguished by its narrower, more rigid form, and the essentially parallel margins, *S. granifera* being much expanded before bifurcation; also, by the somewhat more regularly disposed cell apertures, the spinuliform processes from the inner face of the cell walls, the more slender and much more numerous interapertural striations, and the absence of nodes or granules on the striations and peristomes. When that species is worn, so that the granules are obsolete, the similarity of the two species is much greater. From *Intrapora puteolata* of the Upper Helderberg group it is distinguished by the more rigid appearance of the frond, the essentially parallel margins, the larger, more distant cell apertures, and the spinuliform processes from the inner face of the cell walls.

Formation and locality.—Hamilton group, Fall-brook, four miles from Canandaigua lake, Ontario county, N. Y.

Stictopora recubans.

Stictopora recubans, Hall. Palaeontology of New York, vol. vi, p. 260, pl. lxiii, figs. 20, 21, 1887.

* * * * *

The characteristics of the species are the comparatively broad, flat, non-celluliferous marginal space, and the oblique, recumbent marginal apertures, with a great portion of their cell walls exposed above the substance of the frond. This species very closely resembles *S. vermicula* of the Upper Helderberg group, but the non-celluliferous marginal space is wider, the ranges of apertures are fewer in number, there being eleven or twelve ranges on that species, the ranges of apertures are more distant, the apertures are not so distinctly pustuliform, the cell walls of the marginal apertures are more exposed, and the longitudinal ridges are more

distinct, but the manner of growth and general appearance of the two species are very similar. The curved branches, broad non-celluliferous marginal space, the oblique and recumbent marginal cells, will distinguish it from any other species at present known from the Lower and Upper Helderberg and Hamilton groups.

Formation and locality.—Hamilton group, shores of Seneca lake, Seneca county, N. Y.

Stictopora subcarinata.

Stictopora ? subcarinata, Hall. Trans. Albany Institute, vol. x, p. 191, 1881.

“ (s. g. ?) *dichotoma*, Hall. By error. Report of State Geologist for 1883, p. 48, 1884.

Stictopora subcarinata, Hall. Paleontology of New York, vol. vi, p. 261, pl. lxiii, figs. 1-6, 1887.

* * * * *

When the fronds are well preserved this species will be easily distinguished from *Acrogenia prolifera* by the entirely different mode of growth; where only fragments occur it closely resembles that species in some of its aspects, but it may be distinguished by the wider non-celluliferous marginal space, the fewer ranges of cell apertures and the absence of striated longitudinal ridges, the greater variation in size between the marginal and central cell apertures, and the obliquity of the marginal apertures to the axis of the branch; when the central ridge is very prominent, and the others are obsolete, it has some resemblance to *Temiopora exigua*, but generally the difference between the two species is well marked.

Formation and localities.—Hamilton group, two and one-half miles east of Alden Station, Erie county; Bellona, Yates county, and York, Livingston county, N. Y.

Semiopora bistigmata.

Semiopora bistigmata, Hall. Trans. Albany Institute, vol. x, p. 193, 1881.

“ “ “ Report of State Geologist for 1883, p. 51, 1884

“ “ “ Paleontology of New York, vol. vi, p. 262, pl. lxii, figs. 27-29, 1887.

* * * * *

This species is found associated with *Stictopora incrassata*, and its manner of growth is very similar, but it is easily distinguished by its much more slender form, smaller cell apertures, and inter-

apertural pits. In some conditions of weathering it somewhat resembles *Stictipora perarcta* of the Upper Helderberg group, but may be distinguished by its more robust form, larger cell apertures, and interapertural pits; from any other species, at present known, from the Lower and Upper Helderberg and Hamilton groups, it may be distinguished by its slender form, distant bifurcations, parallel margins and interapertural pits.

Formation and locality.—Hamilton group, West Williams, Ontario, Canada.

Prismopora dilatata.

- Prismopora dilatata*, Hall. Trans. Albany Institute, vol. x, p. 193, 1881.
 “ “ “ Report of State Geologist for 1883, p. 50, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 265,
 pl. lxii, figs. 13, 14, 1887.

* * * * *

This species is of rare occurrence. It differs from other forms of *Prismopora* at present known in having lateral branches. It may be distinguished from *P. triquetra* and *P. subconcava* of the Upper Helderberg group, by its much wider branches and larger, more irregularly disposed cell apertures; from *P. paucirama* it may be distinguished by the greater concavity of the sides of the branches, more frequent branching, and much larger cell apertures; from *P. sparsipora* by the much larger, circular and crowded cell apertures; from other species at present known it is distinguished by its large size and frequent branching.

Formation and locality.—Hamilton group, near Leonardsville, Madison county, N. Y.

Prismopora lata.

- Prismopora lata*, Hall. Palæontology of New York, vol. vi, p. 266.
 Not figured, 1887.

* * * * *

This species in size approaches most nearly to *P. dilatata*, but it may be distinguished by the much less frequent bifurcations, the much less concave sides; the more distant cell apertures, their trilobate form, and their disposition in oblique ascending rows; from *P. pauciramus* of the Upper Helderberg group, by its broader form, the triangular spaces along the margin destitute of

apertures, and the much more numerous apertures; in that species there are only nine or ten apertures in the space across the branch, while in this species there are from fifteen to twenty; from *P. triquetra* and *P. subconcava*, it is easily distinguished by its much larger branches.

Formation and locality.—Hamilton group, Hill's gulch, four miles south of LeRoy, N. Y.

Ptilodictya parallela.

Ptilodictya parallela, Hall. Palaeontology of New York, vol. vi, p. 270, pl. lxi, figs. 7, 8, 1887.

* * * * * * * *

When the whole frond is preserved this species is characteristic and will be readily distinguished; when occurring only in fragments, it sometimes closely resembles *Acrogenia prolifera*, in some of its aspects, but it may be distinguished by the somewhat larger, less oblique cell apertures, and the more uniform size of the longitudinal ridges; in that species the central ridge is usually much more prominent, frequently having two or three times the width of the others, and they are all often striated. The branches of this species are very gently convex, while in that one they are subangular; but sometimes the resemblance is very close and from small fragments alone it is difficult to distinguish the species. From *Stictopora subcarinata* it is distinguished by the wider frond, the extremely narrow non-celluliferous marginal space, the more uniform size of the apertures, and the prominent ridges separating the ranges of apertures. From other forms of *PTILODICTYA* it is distinguished by the circular, comparatively distant cell apertures; from *Stictopora trilincata* it is distinguished by the circular cell apertures, wider fronds, more numerous ranges of apertures and the prominent longitudinal ridges; from *Stictopora rectilinea* by the circular apertures and smooth longitudinal ridges; from *S. subrigida*, *S. angularis*, *S. lineata* and *S. recta* it is distinguished by the much wider frond, greater number of ranges of apertures, and narrow, prominent, smooth ridges.

Formation and localities.—Hamilton group, Darien Centre, Genesee county, and near the head of Canandaigua lake, Ontario county, N. Y.

Ptilodictya plumea.

Ptilodictya plumea, Hall. Palæontology of New York, vol. vi, p. 271, pl. lxi, figs. 9-12, 1887.

* * * * *

This species most nearly resembles *P. retiformis*, but may be distinguished by the more nearly circular, more distant cell apertures, and the convex, granulose, interapertural space; from *P. scutulata* it may be distinguished by the wider frond, the more distant cell apertures, and the convex interapertural space; from *P. falciformis*, Nich., *P. tenuis*, *P. nebulosa* and *P. lirata*, it may be distinguished by the irregular disposition of the cell apertures; in those species the apertures being arranged in longitudinal rows.

Formation and locality.—Hamilton group, Hamburg-on-the-Lake, Erie county, N. Y.

Thamniscus pauciramus.

Thamniscus pauciramus, Hall. Trans. Albany Institute, vol. x, p. 197, 1881.
 “ “ “ Report of State Geologist for 1883, p. 60, 1884.
 “ “ “ Palæontology of New York, vol. vi, p. 274, not figured, 1887.

* * * * *

This species may be distinguished from *Thamniscus variolata* of the Lower Helderberg group, by the much more slender branches, less frequent bifurcations, and much more closely disposed cell apertures; from *T. Cisseis* by the less robust appearance of the frond, the more slender branches and smaller cell apertures; from *T. Nysa* by the more slender branches, less frequent bifurcations, and more closely disposed cell apertures. From *T. multiramus* of the Upper Helderberg group by the more slender branches, comparatively less frequent bifurcations, smaller fronds and their much more delicate appearance; from *T. nanus* by the less frequent bifurcations, the more uniform size of the branches, and the much more closely disposed cell apertures.

Formation and locality.—Hamilton group, Menteth's point, west shore of Canandaigua lake, Ontario county, N. Y.

Hederella conferta.

- Ptilionella conferta*, Hall. Trans. Albany Institute, vol. x, p. 195, 1881.
 " " " Report of State Geologist for 1883, p. 56, 1884.
 " " " Palæontology of New York, vol. vi, p. 279, not
 figured, 1887.

* * * * *

This species may be distinguished from *Reptaria penniformis* by the different appearance of the axial tube, the greater diameter of the cell tubes, their more nearly cylindrical form, and the absence of regular annulations; from *Ptilionella nodata* it is easily distinguished by the absence of prominent regular annulations; from *Hederella cirrhosa* it is distinguished by the much larger cell tubes, their comparatively more frequent occurrence, and the more compact appearance of the frond; from *H. canadensis* by the larger more frequent cell tubes and the more compact appearance of the frond. The cell tubes are of nearly the same size as those of *H. filiformis*, but they are of more frequent occurrence and are never nearly parallel with, nor have their margins in contact with the axial tube, but diverging and having their margins in contact with each other, presenting a more compact appearance than that species; from *H. magna* it is distinguished by the much smaller size of the cell tube.

Formation and locality.—Hamilton group, Darien Centre, Genesee county, N. Y.

Ptilopora striata.

- Ptilopora striata*, Hall. Trans. Albany Institute, vol. x, p. 196, 1881.
 " " " Report of State Geologist for 1883, p. 58, 1884.
 " " " Palæontology of New York, vol. vi. p. 283, pl. lxvi,
 figs. 30–33, 1887.

* * * * *

This species may be distinguished from *P. tenuis* by the stronger midrib and the more frequent lateral branches; in that species the interval between the branches is nearly twice as great as in this species; from *P. nodosa* it may be distinguished by the more frequent branches and the absence of prominent nodes on the celluliferous face of the midrib and branches.

Formation and localities.—Hamilton group, Moscow, Livingston county, and other localities in Central and Western New York, and also at West Williams, Ontario, Canada.

Ptilopora nodosa.

- Ptilopora nodosa*, Hall. Trans. Albany Institute, vol. x, p. 196, 1881.
 " " " Report of State Geologist for 1883, p. 59, 1884.
 " " " Palæontology of New York, vol. vi, p. 285, pl. lxvi,
 fig. 25, 1887.

* * * * *

This species may be distinguished from *P. striata* by the more slender, non-tapering midrib, more distant lateral branches, and the presence of a line of nodes along the middle of the celluliferous face of the midrib and branches; from *P. infrequens* it may be distinguished by the more frequent lateral branches; in that species the intervals between the branches being equal to three or four times the width of the branches.

Formation and locality.—Hamilton group, railroad cutting, two and one-half miles east of Alden station, Erie county, N. Y.

NOTES ON THE GENUS ACIDASPIS.

NOTE ON CORONURA ASPECTANS, CONRAD.

OBSERVATIONS ON TERATASPIS
GRANDIS, HALL.

By J. M. CLARKE.

NOTES ON THE GENUS ACIDASPIS.

By J. M. CLARKE.

Communicated to the State Geologist, December, 1890.

The genus ACIDASPIS, as the term is currently accepted, may be regarded as one of the more compact and homogeneous groups of the trilobites. It may be safely said that it is the pre-eminent influence of the great Barrande, the profoundest student and foremost authority on these fossils, that has brought the name into general usage, though until later years the term proposed by Emmrich, ODONTOPLEURA, has found favor with the German writers.

Conformity to the rules governing nomenclature, which are intended to render justice to every investigator, does not uphold this usage. There is an evident disposition abroad, and one most heartily to be indorsed, to ascertain as far as possible from the descriptions by earlier writers, their intentions. The original diagnoses may have been brief, all too brief to satisfy the present requirements of our science, their illustrations insufficient or faulty, but it will not suffice to reject a name upon these grounds alone. "Too imperfectly described to be identified," is a decree which often veils an unbecoming aspiration after immortality unrelieved by an abiding conviction of the necessity and justice of making every effort to establish the results of another's investigations.

Many of the terms which have been proposed for genera of palaeozoic fossils and have fallen into desuetude from the general belief that they are synonyms have a certain definite value; with the advance in our knowledge, and with the greatly augmented size of the generic groups with which we have to deal, many of these names must be revived in their original and strictest significance.

The pertinence of these remarks does not make itself so strikingly apparent in the group of trilobites termed ACIDASPIS, as in many other cases that might readily be indicated. We desire, however, to call attention briefly to the value of various terms which have been propounded for members of this group, expressing at the same time our conviction in regard to their respective values.

The name CERATOCEPHALA was proposed by John A. Warder in 1838,* for a fossil from Springfield, Ohio, well described and illustrated by him. The original specimen, which received the name of *Ceratocephala*

* American Journal of Science and Arts, vol. xxxiv, p. 377.

goniata, was a large cephalon of a trilobite with bases of conspicuous spines upon the occipital ring. That the author figured the specimen in an inverted position, and regarded the occipital spines as antennæ, does not in the least affect the value of this very appropriate generic term. Barrande* recognized the priority of Warder's description, and stated that the term would be entitled to adoption by palæontologists were it not that de Candolle had previously made use of the name *Ceratocephalus* for a genus of plants. Though the two words have the same origin, this fact need not at all affect the validity of both, more especially since they have been used in different departments of natural history, where there is not the slightest possibility of their being confounded. Furthermore, it has been stated by Captain Vogdes† that de Candolle's name is no longer recognized by botanists, but has been absorbed into the genus *Ranunculus*. If this be the case, it may serve to fortify the later term, though not materially, for it is perhaps more than likely that de Candolle's term will eventually be resuscitated with a restricted value. For us, however, the existence of de Candolle's term does not in the least affect the value of that of Warder, as the two words are different.

Prior to the use of term CERATOCEPHALA no distinctive name had been applied to these crustacea. Dalman‡ and Hisinger§ had mentioned them under the name PARADOXIDES; ACIDASPIS, Murchison, ODONTOPLEURA, Emmrich, POLYERES, Rouault, TRAPELOCERA, SELENOPELTIS, Corda, DICRANURUS, ACANTHOLOMA, Conrad, terms which have been applied to species of the same group, are all of later date. As a generic term in its broader sense, that is, in the meaning with which ACIDASPIS is now applied, CERATOCEPHALA, must take the precedence of all the rest.||

Conceding the prior right of this early American writer, we have still before us an interesting inquiry as to whether some of the names subsequently proposed have not a positive value as titles of subsidiary groups.

CERATOCEPHALA was founded on the species *C. goniata*, Warder, which, according to the author was found "in the same locality with the *Calymene Blumenbachii*, *bufo*? *phylactainoides*, and other rare

*Système Silurien, vol. 1, p. 693.

†Proceedings Academy Natural Sciences, Philadelphia, 1877.

‡Arsberät. om ny zool. arbet. och upptäckt. p. 135, 1828.

§Lethaea Svecica, p. 12, 1837.

|| The only writer who has urged the claims of Warder's term is Captain A. W. Vogdes, in the paper already cited in the Proceedings of the Philadelphia Academy for 1877. ("Notes on the genera *Acidaspis*, *Odontopleura*, and *Ceratocephala*."") In his recent valuable "Bibliography of Palæozoic Crustacea" (Bulletin No. 63, U. S. Geological Survey) Captain Vogdes has, however, retained the name ACIDASPIS.

fossils;" in other words is a Niagara species. The name of this species has suffered the same obscurity as that of its genus, and has never been admitted to recognition. Barrande observed the close similarity of Warder's figure of *C. goniata* to his *Odontopleura* (1846) or *Acidaspis* (1852) *Verneuli*, and has represented on his plate 38 (fig. 3) a cephalon in a similar position to that given by Warder. For the purpose of comparison copies of both are here introduced. It will be observed that the size attained by these closely related animals is very large compared to that usually prevailing among members of "ACIDASPIS." Barrande's species is from a correlative horizon, his etage E₂. Professor Hall has described* a species from the Niagara limestone at Bridgeport near Chicago, *Acidaspis Danai*, with which the *A. Ida*, Winchell and Marcy,† is a synonym. The figures of this species given by Professor Hall show with sufficient clearness that this form is identical with *Ceratocephala goniata*, Warder.

In 1847 Corda described‡ the genus TRAPELOCERA, the first of five species being *T. rhabdophora*, Corda, which Barrande subsequently showed to be a synonym of his *Acidaspis Verneuli*. Whatever value this term might have had is therefore lost by its being in all respects synonymous with CERATOCEPHALA.

CERATOCEPHALA in its restricted sense has this positive value. It embraces such forms as agree with the type *C. goniata*, in having a large subquadrate cephalon, strong ridges running from the eyes along the outer branch of the facial suture to the anterior extremity of the glabella, and two strong, straight, divergent spines on the axis of the occipital ring. It will include *Acidaspis Verneuli* and *A. tremenda*, Barrande, *A. vesciculosa*, Beyrich, *A. bispinosa*, McCoy (not Emmrich), *A. Barrandii*, Fletcher and Salter; it is of quite restricted range and specific representation.

The name ACIDASPIS, proposed by Murchison in 1839,§ was founded on the species of *A. Brighti*, Murchison, the part described being the intra-sutural portion of a cephalon characterized by the sharp division of the lateral glabellar lobes and the broad occipital ring produced into a single stout median spine. Species of this type of structure

* Geology of Wisconsin, vol. 1, p. 432, 1862. See for illustration Twentieth Report, N. Y. State Cabinet, pl. 21, figs. 8, 9, 1837 and revised edition, 1870.

† Memoirs of the Boston Society of Natural History, vol. 1, p. 106, pl. 2, fig. 13, 1865.

‡ Prodrum einer Monographie der böhmischen Trilobiten, p. 158. This work, published over the names of Ignaz Hawle and A. J. C. Corda, has, since the publication by Barrande of a disclaimer by Hawle of any participation in its composition, been generally accredited to Corda alone.

§ Silurian System, p. 658.

are usually of small size and are widely distributed, having a very considerable vertical range from the lower Silurian into the middle or upper Devonian. They are subject to variation in some features, especially in the number and arrangement of the spines upon the pygidium, and in this respect afford no means of distinction from the members of other divisions of the genus CERATOCEPHALA.

In 1839 Emmrich proposed* the term ODONTOPLEURA, apparently not in ignorance of Murchison's term, but because he considered it insufficiently defined in being based upon a fragmentary specimen. He described and figured *Odontopleura ovata*, Emmrich, which must be taken as typical of his proposed genus. This species was afterwards refigured by him in 1845† under the name *O. bispinosa*. A highly finished figure of this species, was also given by Burmeister in 1843,‡ made, as it is stated, from the original specimen under the direction of the late H. Von Dechen,§ and from these figures it appears that the species is characterized by the great breadth of body, and by the occipital ring being smooth, or with a central tubercle, but without spines.

In 1840 Conrad described the species *Acidaspis tuberculatus*,|| a well-known form of the Lower Helderberg fauna, his description being based upon the intra-sutural portion of a cephalon. The species is strictly congeneric with *A. Brighti*, Murchison. At the same time he described without figure or specific designation a fossil to which he gave the name ACANTHOLOMA,¶ and it would appear both from his description and from the opinion expressed by Professor Hall in 1859** that the author had under consideration a free cheek of the same species of ACIDASPIIS.

In the report for 1841, Conrad proposed †† the name DICRANURUS for a fossil there figured, also from the Lower Helderberg fauna. This form was mentioned in a list given on a preceding page of the same report as *Dicranurus hamatus* and under the name *Acidaspis hamata* it has become known as one of the peculiar species of this fauna. The

*De Trilobitis, p. 35, plate, fig. 3.

†"Ueber die Trilobiten," (Nenes Jahrbuch für Mineralogie, etc).

‡Organization der Trilobiten, pl. 2, fig. 11.

§ Burmeister states that this specimen in the Museum of the University of Berlin, was the only one known of the species, and Heldenbain in 1869 makes the same statement (Zeitschrift der deutschen geologischen Gesellschaft, vol. 21. p. 167).

|| Third Annual Report on the Palæontological Department of the Survey, p. 205, fig. 3 of the plate accompanying a few copies of the report for the following year. (See Fifteenth Report N. Y. State Cabinet.)

¶ In his report for the following year Conrad used the term *Acantholoma spinosa* in a list of fossils, but without further definition.

**Palæontology of New York, vol. 3. p. 370.

†† Page 48, plate, fig. 1.

species is not well known except from its cephalon which is notable for the extraordinary pair of curved spines originating upon the very broad occipital ring, making almost an entire revolution in a spiral outward curve and resembling a pair of grappling irons. Mr. Conrad regarded this fossil as the entire animal, describing it as without thoracic segments but with a tail prolonged into two great spines; hence the generic name, which is thus a misnomer, but can not be impeached on such a ground. But a single additional species of this well characterized group is known, the *Acidaspis monstrosa*, Barrande, from an equivalent horizon, the etage G. Fragments of the thorax known to belong to these species have been figured by both Hall and Barrande and they indicate structure similar to that of the *Ceratocephalæ* generally, straight pleuræ, prolonged into spines which are abruptly curved backward and greatly produced. Barrande also figures* a very incomplete pygidium which he surmises may belong to *A. monstrosa*, but it has a lichadiform structure and is totally unlike that figured by Professor Hall† in connection with a portion of the thorax of *A. hamata*. The original of the latter drawing is in the collection of the State Museum, but the pygidium, which had become detached and been gummed in place, has again become loosened and lost, a most regrettable circumstance as assiduous search in the Lower Helderberg rocks which has produced many fine specimens of this fossil has failed to discover another of the pygidium. We may, however, confide in the accuracy of the original representation of this part, in which the pygidium appears to have been of small size, semi-circular in outline, with a single projecting spine on each side near the anterior margin. The figures given on the accompanying plates of the American and Bohemian species will serve to indicate the distinctive characters of this group.

In the work of Corda's already cited (1847) the name *SELENOPELTIS*‡ was proposed, and four species described, *S. Stephani*, *S. Buchi* (*Odontopleura Buchi*, Barrande, 1846), *S. Beyrichi*, and *S. Humboldti*. Barrande demonstrated in 1852§ that all the fossils thus described represented but one species, his *Acidaspis Buchi*. Corda's generic name was well defined and fully illustrated. This species *Acidaspis Buchi* is remarkable in many respects and we have reproduced Barrande's figure of the entire animal which is almost a copy of that

* Vol. 1, Supplement, pl. 15, fig. 3.

† Palæontology of New York, vol. 3, pl. 79, fig. 19.

‡ Page 34.

§ Page 746.

given by Corda. The median lobe of the glabella is small, the lateral lobes, instead of being more or less distinctly in two pairs, are confluent and exceedingly irregular; the occipital ring is devoid of spines or conspicuous tubercles and the long cheek spines take their origin above the genal angles and on the upper surface of the cheeks. The thoracic segments are very broad, each annulation bearing at its junction with the pleura a very strong node; the pleural ridges are not direct as in other species, but cross the entire width of the pleurae obliquely from below upward and are there recurved into very long spines. The pygidium is described by both Corda and Barrande as without marginal spines and hence Corda's name. But Barrande has figured one very imperfect specimen retaining a single spine and in the figure, here copied, they were drawn in dotted lines. The cephalon is also without marginal spines. A comparison of these features with those of the other groups already indicated leaves no doubt that the single example of this type of structure stands well apart from its allies.

In the same year that Corda's "Prodrom" appeared (1847) the term POLYERES was used by Rouault* in a list of the paleozoic fossils found in the vicinity of Rennes, Brittany, for a trilobite which Barrande, after a personal inspection of the specimens, pronounced identical with his *Acidaspis Buchi*. Rouault's description of his genus was very brief. The essential character upon which it was based being the long thoracic spines. The single species mentioned, *Polyeres Dufrenoyi*, Rouault, was not figured. It must be admitted that from the original description alone of POLYERES it would be difficult to recognize its value, but the opinion expressed by Barrande fully determines its worth. As it is necessary to choose between the two terms SELENOPELTIS and POLYERES proposed the same year, it seems the wiser course to accept Corda's name, which was not only clearly defined but was also illustrated.†

It appears from the foregoing that many of the generic names which have been proposed for the trilobites known as ACIDASPIS, have a certain permanent value. If we admit these terms in a classification, the subdivision of the entire group of CERATOCEPHALA is found

* Bulletin de la Société géologique de France, 2 ser. vol. 4, p. 320. This paper was read at the session of December, 1846, and its date is thus quoted by both Barrande and Vogdes. The cover of these *feuilles* 20-25 bears the date of April, 1847.

† In spite of the serious indisposition toward Corda's work evinced by Barrande, a feeling which is explained by the circumstances connected with the appearance of this monograph, it becomes increasingly evident that it contains many kernels of good grain, though concealed among much chaff. The chaff has been sufficiently brought to the foreground. It is obligatory upon students of paleontology to lose sight of the personal differences of a passing generation and uphold the truths that this investigator was fortunate enough to elicit.

to be based to an important degree upon the structure of the occipital ring of the cephalon, whether it be smooth (or with a central tubercle), unispined, bispined, etc. The variations of this character, upon which the subdivisions CERATOCEPHALA (*sensu stricto* TRAPELOCERA), ACIDASPIS and ODONTOPLEURA depend, is not one of high morphological value, but it is not infrequently that variation in such minor details as this has proved of the greatest convenience in a subsidiary classification of the trilobites, for example, among the Phacopidæ and the Proetidæ. In the entire group of CERATOCEPHALA there is no more important variation in essential characters than that of the ankylosis of the cheeks with the cephalon in *Acidaspis Verneuri* and its allies, and the confluence of the lateral glabellar lobes in *A. Buchi*.

The usefulness of the subdivision proposed in the following lies primarily in the homogeneity of the groups and secondarily in the fact that it retains in their original value names of long standing.

SCHEME OF CLASSIFICATION.

Genus CERATOCEPHALA, Warder, 1838 :

Glabella with a long central lobe extending from near the anterior margin of the cephalon to the occipital ring; lateral lobes in two pairs, generally quite distinct from the central lobe. The facial sutures originate just within the genal angles, passing over the ocular nodes and cutting the frontal margin where their anterior terminations are separated by the width of the glabella; rarely obsolete from coalescence. Eyes small. Thoracic segments generally nine, sometimes ten; extremities of the pleuræ produced into spines. Pygidium with two or three annulations. Margins of cephalon and pygidium and surface of the test generally abundantly supplied with spines.

Type, *Ceratocephala goniata*, Warder.

1. Species having the occipital ring

(a) *Smooth or with a central tubercle.*

ODONTOPLEURA, Emmrich. Type, *O. ovata*, Emmrich.

(b) *With a single, large, straight, median spine.*

ACIDASPIS, Murchison. Type, *A. Brighti*, Murchison.

Synonym, *Acantholoma*, Conrad.

(c) *With two straight, divergent spines.*

CERATOCEPHALA, Warder, *sensu stricto*. Type, *C. goniata*, Warder.

Synonym, *Trapelocera*, Corda.

(d) *With two spirally recurved spines of great size.*

DICRANURUS, Conrad. Type, *D. hamatus* (Conrad), Hall.

2. Species with confluent glabellar lobes, oblique thoracic pleuræ and spineless pygidium.

(e) SELENOPELTIS, Corda. Type, *S. Buchi*, Barrande.

Synonym, *Polyeres*, Rouault.

To these it is necessary to add another to include an extravagant form known only from its pygidium, but whose relations are nearest to the genus CERATOCEPHALA:

(f) ANCYROPYGE, sub-gen. nov. Type, *Acidaspis Romingeri*, Hall.

(Palæontology of New York, vol. vii, p. 71, pl. 16 B, figs. 15-18, 1888).

Pygidium with a short, unsegmented, bullate axis, flanked on the lateral margins by two elongate nodes. Border broad and flattened, its margin bearing twelve long curved spines, four on each side and four behind; the lateral members strongly recurved, the posterior being straight and less divergent. From the surface of the posterior border arise two other spines just above and within the fourth of the lateral marginal spines; these rise at an angle of nearly 45° and were probably nearly of the same length as the rest.

The character of this remarkable trilobite will be seen from the accompanying copies of figures from the work above cited.

The felicity of this grouping makes itself apparent upon attempting an arrangement of the species. The more extravagant forms of CERATOCEPHALA are separated under the three divisions SELENOPELTIS, DICRANURUS and ANCYROPYGE and these are represented by but four known species in all. The actual morphological value of the latter is undoubtedly higher and they are better entitled to independence than the remaining groups.

THE AMERICAN SPECIES OF CERATOCEPHALA

In the palæozoic faunas of North America the genus CERATOCEPHALA is not largely represented.

It has been observed that the earliest species described is the *C. goniata*, Warder, 1838, with which, it seems to us, the *Acidaspis Danai*, Hall and *A. Ida*, Winchell and Marcy, are synonymous.

In a supplementary note to Warder's paper in the American Journal of Science, J. G. Anthony described the species *C. ceralepta*. The woodcuts accompanying this description represent two inverted pygidia of small size, the long marginal spines being regarded as antennæ. Mr. Meek subsequently identified, with some doubt, this species from the Hudson river group at Cincinnati, Ohio,* the original

*Palæontology of Ohio, Vol. I, p. 169, pl. 14, figs. 8, 9, 1873.

locality of Anthony's fossils, and gave figures of two pygidia which, for us, seem to establish the validity of Anthony's designation. At the same time Meek gave figures of two glabellas (*loc. cit.*, figs. 6, 7) without proposing therefor any specific name. Both are characterized by long single occipital spine, that of figure 6 very broad and stout, that of figure 7 much more slender. It appears that a cephalon having the structure of the former of these was subsequently described by S. A. Miller as *Acidaspis anchoralis** and with this cephalon Mr. Miller associated a pygidium having the same structure as that of *Ceratocephala ceralapta* as given by Anthony and Meek. From Miller's description it does not appear how forcible the reason may have been for including these separate parts under the same specific name, but should subsequent investigations prove that these parts referred to *Acidaspis anchoralis* do belong to the same species it would seem that Mr. Miller's name must take its place as synonymous for *C. ceralapta*, for Anthony's figures, though not all that could be desired, show a very characteristic feature in the single pair of long pygidial spines, which do not occur in any other of the known species of this fauna.

In 1842 Dr. John Locke described† the species *Ceraurus crossotus* from the same horizon at Cincinnati. Mr. Meek in the work cited (p. 165, pl. 14, figs. 10 a, b) made an identification of doubtful value (so regarded by him) of this form as a species of *ACIDASPIS*. It is questionable whether this should be accepted as the species intended by Locke and we prefer to refer to it provisionally as *Ceratocephala crosota*, Meek.

In 1847 Professor Hall described‡ *Acidaspis Trentonensis* and *A. spiniger*. The latter has proved to be a *Bathyurus*.

In 1885 Shumard described§ *Acidaspis Halli*, from the Trenton horizon of Missouri.

In 1857 Billings described|| *Acidaspis Horani* from the Trenton limestone, Rivière à la Friponne, near Cape Tourment. The original specimen is described as broken at the occipital ring so that its position in this classification is uncertain.

In 1873 Mr. Meek described¶ in addition to the species already mentioned, *Acidaspis Cincinnatiensis*, from the Hudson River group, the original being a pygidium with two thoracic segments attached.

* Cincinnati Quarterly Journal of Science, vol. 2, p. 349, figs. 2-4, 1875.

† American Journal of Science, 1st Ser., vol. 44, p. 347, fig.

‡ Palæontology of New York, vol. I, p. 240, pl. 64, fig. 4, a-f; p. 241, pl. 64, fig. 5.

§ First and Second Report Geological Survey of Missouri, pt. 2, p. 200, pl. B, figs. 7, a-c.

|| Report to Sir W. E. Logan for 1856, p. 341.

¶ Palæontology of Ohio, vol. I, p. 167, pl. 14, fig. 3.

In 1875, S. A. Miller described from the Hudson River group, *Acidaspis anchoralis*, to which reference has been made, and *A. O'Neilli*.*

In 1876, Professor Hall referred to *Acidaspis* n. sp.? forms subsequently described as *Ceratolichas gryps*, Hall, † and *C. dracon*, Hall, ‡ from the Corniferous limestone of New York. At the same time he referred the species *Terataspis grandis*, Hall, and *Lichas Eriopis*, Hall, to ACIDASPIS and indicated a pygidium of *L. Eriopis* as *Acidaspis* (*Terataspis*) sp.? §

In 1879, Mr. C. D. Walcott described, || without illustration, *Acidaspis parvula* from the Trenton limestone of Trenton Falls, N. Y.

In 1879, Professor Hall described ¶ *Acidaspis fimbriata* from the Niagara group at Waldron, Indiana. The original specimen was a free cheek of which a figure was first given in 1883.**

In 1887, Mr. A. F. Foerste described †† the species *Acidaspis Ortoni* from the Clinton shales near new Carlisle, Ohio.

In the Paleontology of New York, Vol. VII, 1888, *Acidaspis callicera* was described, ‡‡ a species occurring in the Schoharie grit and Corniferous limestone of New York and Canada. A large pygidium was also referred to this genus but without specific name, |||| (Corniferous limestone, Cayuga, Ontario). Under the name *Acidaspis Romingeri*, was described ¶¶ the form which we have taken as a type of new sub-genus, ANCYROPYGE, from the Hamilton fauna of Little Traverse Bay, Michigan.

These North American species arrange themselves under the proposed grouping as follows :

Genus CERATOCEPHALA, Warder, 1838.

CERATOCEPHALA, Warder, *sensu stricto*.

C. goniata, Warder, 1838.

Synonyms *Acidaspis Danai*, Hall, 1862.

A. Ida, Winchell and Marey, 1865.

ACIDASPIS, Murchison, 1839.

A. anchoralis, Miller, 1875.

= ?? *A. ceralepta*, Anthony (sp.), 1838.

A. tuberculatus, Conrad, 1840.

* Cincinnati Quarterly Journal of Science, vol. 2, p. 86, fig. 9.

† Illustrations of Devonian Fossils, pl. 19, fig. 1.

‡ Idem, figs. 2, 3.

§ Idem, figs. 4-11, 12.

|| Thirty-first Report N. Y. State Museum (1879), advance sheets, p. 16.

¶ Description of New Species from the Niagara group, p. 20.

** Eleventh Report State Geologist of Indiana, pl. 33, fig. 11.

†† Bulletin Scientific Laboratories Denison University, vol. 2, p. 90, pl. 8, fig. 1.

‡‡ P. 69, pl. 16 B, figs 1-13.

|||| P. 16 B, fig. 14.

¶¶ P. 71, pl. 16 B, figs. 15-18.

ODONTOPLEURA, Emmrich, 1839.

O. Trentonensis, Hall (sp.), 1847.

O. parvula, Walcott (sp.), 1877.

O. Halli, Shumard (sp.), 1855.

O. crossota (Locke?), Meek (sp.), 1873.

O. O'Neilli, Miller (sp.), 1875.

O. Ortoni, Foerste (sp.), 1887.

O. callicera, Hall (sp.), 1888.

DICRANURUS, Conrad, 1841.

D. hamatus, Conrad, 1841.

ANCYROPYGE, Clarke, 1891.

A. Romingeri, Hall (sp.), 1888.

Species unclassified:

? *Ceratocephala ceralepta*, Anthony, 1873.

C. Cincinnatiensis, Meek (sp.), 1873.

C. Horani, Billings (sp.), 1857.

C. fimbriata, Hall (sp.), 1879.

EXPLANATION OF PLATE I.

CERATOCEPHALA GONIATA, *Warder.*

Fig. 1. Copy of the original figure. From *American Journal of Science and Arts*, vol. xxxiv, No. 2, p. 378.

ACIDASPIS VERNEUILI, *Barrande.*

Fig. 2. Outline copy of a cephalon viewed from in front as in the preceding figure. *Barrande*, *Système Silurien du Centre de la Bohême*, vol. I, pl. 38, fig. 3.

Fig. 3. The entire individual. *Barrande*, *loc. cit.*, fig. 5.

TRAPELOCERA HOERNESI, *Corda.*

Fig. 4. Copy of the original figure. *Corda*, *Prodrome Einer Monographie der böhmischen Trilobiten*, pl. vii, fig. 79a.

DICRANURUS HAMATUS, *Conrad.*

Fig. 5. Copy of the original figure given on the reproduction of the original plate (Fifteenth Rept. N. Y. State Museum), designed to accompany Mr. Conrad's report for 1841.

Fig. 6. A figure from a cephalon retaining all the parts except the free cheeks. From the trilobitic layers of the Delthyris Shaly limestone at Slingerland's, near Clarksville, N. Y.

Fig. 7. The pygidium and a portion of the thorax as given in *Palaeontology of New York*, vol. iii, pl. 79, fig. 19.

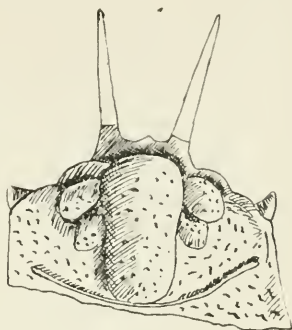
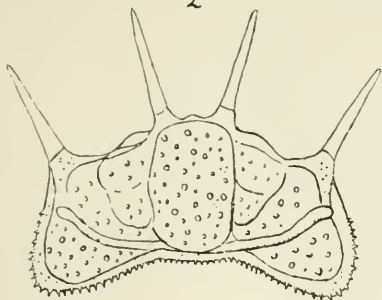
ACIDASPIS MONSTROSA, *Barrande.*

Fig. 8. A specimen showing a portion of the thorax. From *Barrande*, *op. cit.*, Suppl. pl. 15, fig. 1.

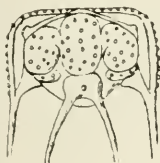
ACIDASPIS BRIGHTI, *Murchison.*

Fig. 9. Copy of the original figure in *Murchison's Siluria*, p. 261, fig. 8.

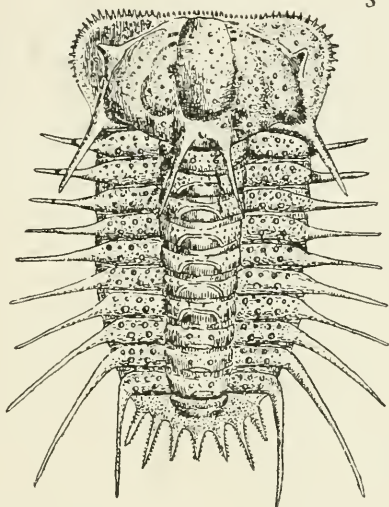
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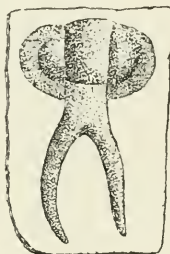
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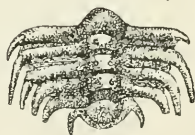
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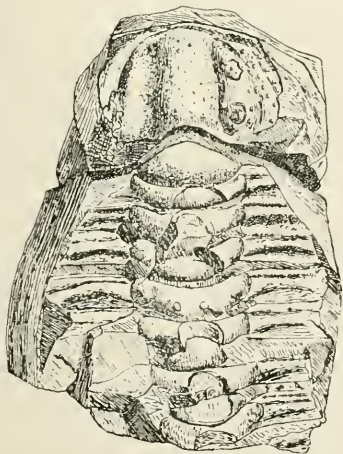
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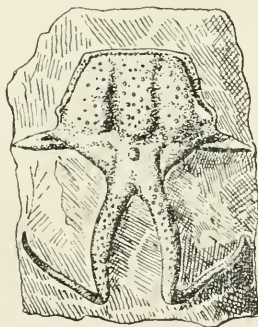
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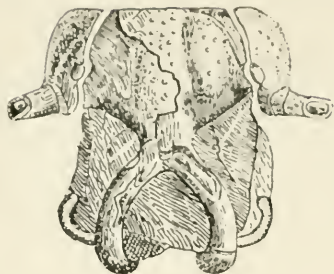
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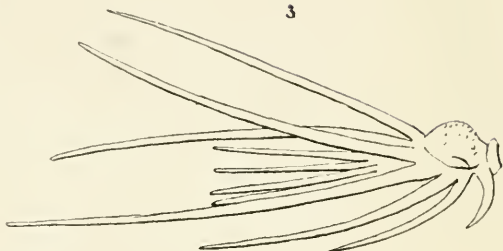
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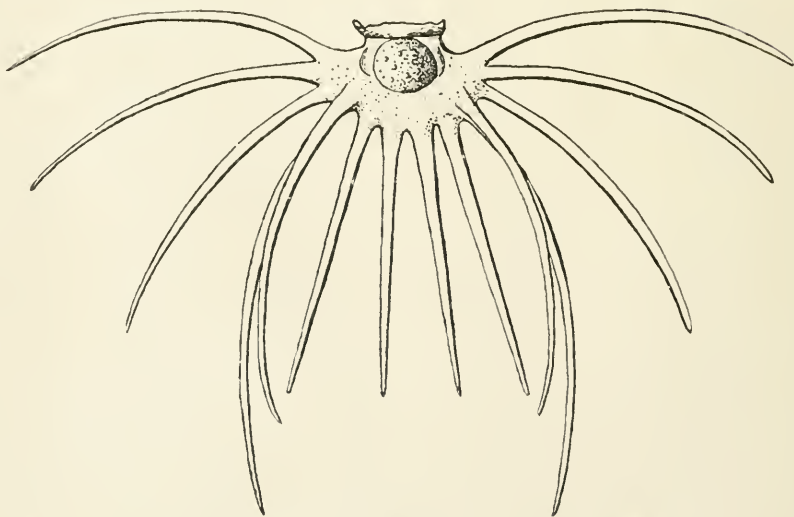
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EXPLANATION OF PLATE II.

ACIDASPIS MONSTROSA, *Barrande.*

Figs. 1, 2. Front and profile of a cephalon retaining the detachable cheeks.
From Barrande, *op. cit.*, Supplement, pl. 11, figs. 19, 20.

ACIDASPIS ROMINGERI, *Hall.*

Figs. 3, 4. Outline figures of the original specimen, copied from Palæontology of New York, vol. vii, pl. 16*b*, figs. 15, 16.

EXPLANATION OF PLATE III.

ODONTOPLEURA OVATA, *Emmrich*.

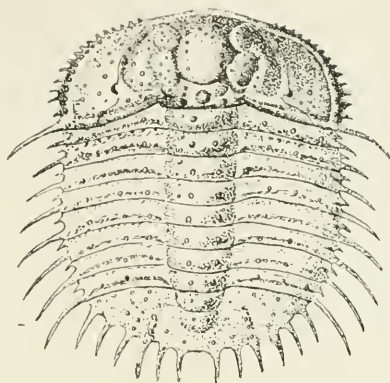
Fig. 1. Copy of the figure given by Burmeister, *Organization der Trilobiten*, pl. 2, fig. 11.

ACIDASPIS BUCHI, *Barrande*.

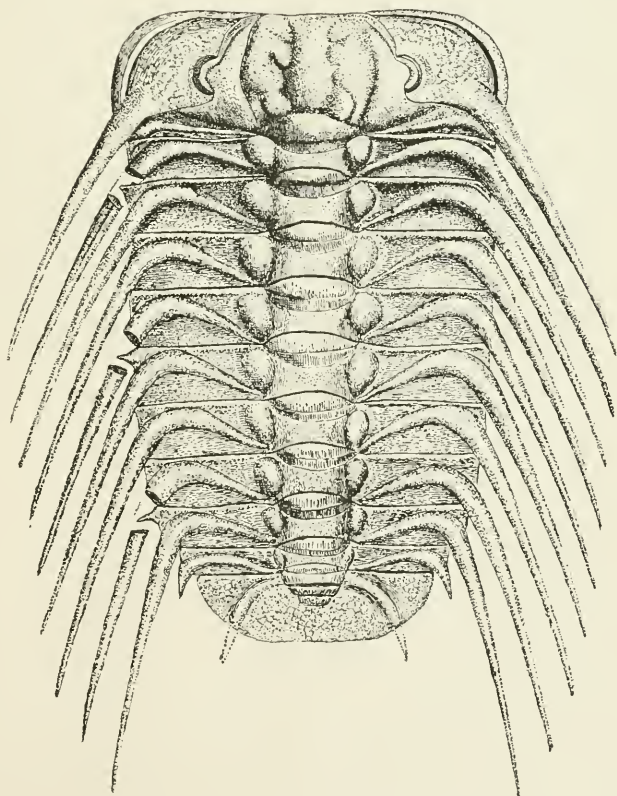
(SELENOPELTIS STEPHANI, *Corda*.)

Fig. 2. An entire individual; after Barrande, *op. cit.*, pl. 37, fig. 25.

1



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NOTE ON CORONURA ASPECTANS, CONRAD (sp.),

The *Asaphus diurus*, Green.

By J. M. CLARKE.

Communicated to the State Geologist December, 1890.

The species *Asaphus aspectans* was founded by CONRAD in 1841* upon a fragment of a cephalon consisting of a free cheek, retaining the lensar surface of the ocular node. This specimen was from the Corniferous limestone at Schoharie, N. Y., and was characterized by the great elevation of the eye (represented by CONRAD as almost semi-cylindrical), the broad and entire marginal border and the coarse tuberculation of the surface. Until the publication of Volume VII of the Palæontology of New York (1888) the name had not been regarded of much value, from the very fact of the obscurity and apparent insufficiency of the original specimen. Professor HALL had reproduced in the Fifteenth Annual Report on the State Cabinet of Natural History (p. 88, 1862) CONRAD's brief diagnosis and his figure, and in a short note of observations refers to a second specimen, curiously enough almost the duplicate of the original; both of these specimens, left free cheeks, are figured on plate 13 of the volume of the Palæontology of New York referred to.

In the study of the Upper Helderberg trilobites made in the preparation of this work it became evident that the large pygidia, not infrequent at some outcrops of the Corniferous limestone, characterized by rows of conspicuous marginal spines and a crescentic posterior extremity, and which were currently referred to the species described by Professor HALL as *Dalmania Helena*, or that by Mr MEEK as *Dalmania Ohioensis*, had possessed a cephalon, the eye and cheek of which must have closely conformed to that described as *Asaphus aspectans*. The evidence, however, that these different parts represented but a single species was rather slender, notwithstanding the fact that so much confidence was there felt of this probability that all these pygidia were referred to CONRAD's species. The argument was on this wise: Professor HALL's *D. Helena* was based upon a poorly preserved pygidium from the Falls of the

* Fifth Annual Report on the Palæontology of the State of New York, p. 49, plate, fig. 9.

Ohio (see *op. cit.* plate 13, fig. 7), from which all the marginal and terminal spines were lost and the pustulous surface worn away. The original of Mr. MEEK's *D. Ohioensis*, from the Corniferous limestone at Marblehead, Ohio, was a pygidium, the surface of which was also worn smooth, but retained the marginal spines. An abundance of these pygidia from Ohio and various localities in New York (especially from the Lime Rock quarries near Le Roy) rendered their specific identity beyond question. In some material from Ohio which had been loaned by Dr. NEWBERRY was a single fragment, comprising nearly one-half of a cephalon, from the Corniferous limestone at Columbus. This retained one very large and greatly elevated eye, and showed agreement with the original of *Asaphus aspectans* in all the features known. There was no other known trilobite in these rocks to which this cephalon could be referred with any confidence of accuracy, and hence it was presumed that this was the cephalon belonging to the pygidia passing under the names of *D. Helena* and *D. Ohioensis*. Its identity with *Asaphus aspectans* was beyond contravention.

Quite recently the State Museum has obtained possession of an entire individual of this species, which has an interesting bearing on the validity of this identification. This fine specimen was secured in the fall of this year by Mr. ALBERT L. AREX, of Rochester, N. Y., at the quarries at Lime Rock. It consists of two portions, the intaglio retaining the crust, and none of the important parts are missing. All details of structure are well retained, the thinness of the crust showing even the finer tuberculations of the surface. This animal, judging from the dimensions of the pygidium, appears to be of about average size, having a length to the extremity of the horns of the posterior crescent of $5\frac{3}{4}$ inches. To this must be added a fraction due to the slight compression of the posterior portion of the thorax, and the original length of the animal was undoubtedly fully $5\frac{1}{4}$ inches. The character of the cephalon confirms in every respect the identification made in Volume VII. The marginal border is very broad, narrowing into short cheek-spines, and the entire surface of border, cheeks and glabella is coarsely tubercled, The margin itself is regular and uninterrupted, as in *Dalmanites Calypso*, HALL, of the same fauna, and in *D. micrurus*, GREEN, of the Lower Helderberg; not crenulated as in the Lower Helderberg. *D. pleuroptyx*, GREEN, the Schoharie grit species, *D. anchiops*, GREEN, nor spined for its entire extent, as in *D. dentatus*, BARRETT, of the Lower Helderberg, nor baculiferous, as in *D. regalis*, HALL, of the Schoharie grit and *D. pygmaeus*, HALL, of the Corniferous, nor dentate on its

anterior arc as in ODONTOCEPHALUS. The eye-lobes are high, the eyes themselves large and elevated. The anterior lobe of the glabella is low, somewhat pentagonal in outline and its definition from the anterior border unusually indistinct. As in most of the DALMANITES of this fauna the lateral members of the first and second pair of lobes are coalesced not only with each other but to a very considerable degree with the eye-lobes. The lateral extensions of the facial suture lie in deep grooves in their passage over the cheeks. The thorax presents no additional features of importance, except that the segments are considerably produced at their lateral extremities, and terminate in sharp points, without showing well-defined articulating faces.

In this specimen, however, the marginal spines of the pygidium are remarkably short, while usually in the New York specimens they are larger than in those from the Corniferous limestone of Ohio. The terminal spines, also, are relatively quite broad and stout and bear on their outer margins three spinules. As far as can be ascertained there is no evidence of erect spines on the crescentic border as in the allied species *Coronura myrmecophorus*, GREEN, but the structure of the posterior crescent shows how closely this form approximates the latter species.

The structure of Mr. CONRAD'S species, *Asaphus aspectans* (which is now to be referred to the genus *Coronura*, proposed in Volume VII of the Palæontology of New York), is established, and it has probably never before happened in the history of discussions upon the trilobites that a species at once so imposing in its proportions and so characteristic of its fauna, has been virtually reconstructed from so insignificant a fragment, with a meager and imperfect description of that.

We believe, however, that CONRAD'S term must yield to an earlier one of Dr. GREEN'S, *Asaphus diurus*, a name which has never been accepted, from certain imperfections in the original description. This species was proposed in the American Journal of Science and Arts, 1839 (vol. xxxvii, No. 1, p. 40, July), under the title "Description of a New Trilobite." In order to apprehend its value, the essential portion of the description is reproduced:

"Clypeo? costis striatis, tuberculatio; cauda bipartita; corpore depresso.

"The fragments of this *Asaph* which I have examined, consist of nineteen articulations of the abdomen and tail. *The costal arches of the lateral lobes are very peculiar. They are marked by a shallow groove, or impressed line on their upper surface, studded on each side with quite a*

regular row of bead-like granulations. On each division of the vertebral column, there is but a single row of pustulations. The lunate caudal end is more expanded than in the cognate species, the *A. Selenurus*, and the concave side of the crescent is more regularly rounded; the whole animal is much more depressed than that species, and the lateral lobes are much wider in proportion to the middle lobe of the back.

"There are two specimens of this fine species in the cabinet of William Wagner, Esq., of Philadelphia, both of which were found in Green county, Ohio, in the neighborhood of Xenia. The largest which measures two inches long and two and a half inches wide, is a plaster cast from a weather-beaten natural mould; the other occurs in a grey, sparry argillaceous limestone rock. It is perhaps worthy of remark, that all the specimens of the *Asaph* with a lunate tail, which I have noticed, were natural moulds, made by the animal in the rock, the shell or body having disappeared."

This description was unaccompanied by any illustrations; that portion, however, that we have underlined is a cogent delineation of the characters of the pygidium of *Dalmanites aspectans*. The fossil is hardly to be mistaken. There are but three species of crescent-tailed trilobites, of the size here indicated, that are now known; *Asaphus* or *Odontocephalus selenurus*, *Asaphus* or *Dalmanites myrmecophorus* and *Asaphus* or *Dalmanites aspectans*. Of these Dr. GREEN had himself described two, though the first is usually referred to EATON, who published it in the same year. They are all members of the same (Corniferous) fauna. In MILLER's Catalogue of the American Palæozoic Fossils, the species is referred to the age of the Niagara; Captain VOGDES in his Bibliography considers it of the age of the Hudson river group, but in neither these nor any other American palæozoic fauna, except the Corniferous, is there any trilobite which even remotely suggests the above description.

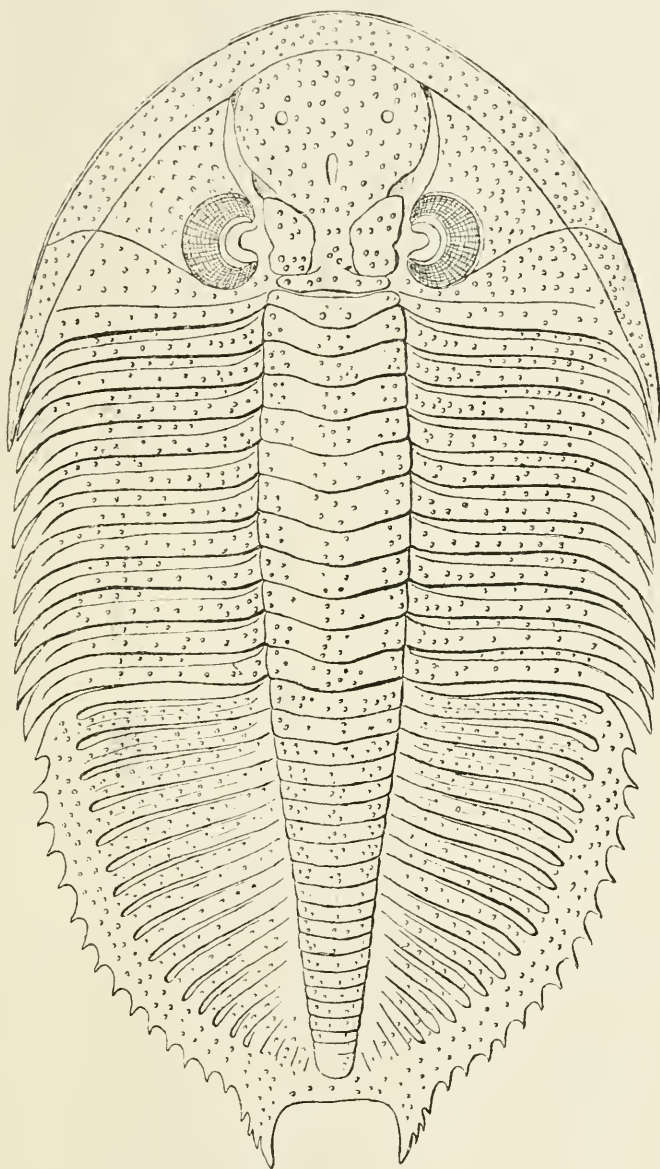
The nineteen articulations of the axis of the pygidium, which perhaps from its unusual size the author considered as "abdomen and tail," the grooving of each pleura by a fine impressed line, on each side of which is a regular row of granules, the form of the posterior crescent and the relative proportions of the axis and lateral lobes are all apparent in the figures given in the Palæontology of New York, Vol. VII, and in that accompanying this paper. In the hope of finding Dr. GREEN's original specimens, search has been made in the collections of the Wagner Free Institute of Science, at Philadelphia, by the favor of its secretary, Mr. CHARLES W. JOHNSON, but the specimens, if extant, are for the time being lost sight of.

Dr. GREEN evidently made an erroneous citation of the locality of these fossils. The Corniferous limestone does not occur near Xenia, and is not known in Green county, Ohio; but an error of this kind is not altogether surprising. No one's knowledge of the geology of Ohio had then attained this degree of discrimination; of the origin of the specimens the author had no personal knowledge; they had come to him through the hands of a collector, upon the accuracy of whose information it is not necessary, in a critical question, to put full reliance.

EXPLANATION OF PLATE IV.

CORONURA DIURUS, *Green* (sp.)

Outline drawing of the only entire individual known.



CORONURA DIURUS, GREEN.



OBSERVATIONS ON THE TERATASPIS GRANDIS, Hall, The Largest Known Trilobite.

By J. M. CLARKE.

Communicated to the State Geologist December, 1890.

Trilobites of great size have been reported from various formations. With rare exceptions, however, these relics are but fragments of the test, leaving to the imagination the restoration of the original proportions of the animal, and without an earnest mental effort one is apt to leave the contemplation of the large fragment with no adequate conception of the imposing lineaments of its owner. Indications of these gigantic forms occur in all the grand faunas of the Paleozoic, with the exception of the Carboniferous where diminution in numbers was accompanied by diminution in size, or, in other words, by the prevalence of genera in which great size was never attained.

Almost with the earliest known appearance of the Trilobites the genus PARADOXIDES attained magnificent proportions. *Paradoxides Harlani*, the well-known species of the Braintree argillites, must have grown to a length of 18 inches. ANGELIN has figured an entire specimen of *P. Tessini* 12 inches in length, and BARRANDE a fragment of an individual of *P. imperialis* which must have had about the same size. Mr. G. F. MATTHEW has described a nearly entire individual of an immense *P. regina* from the St. John beds, 15 inches long and 12 inches across the base of the cephalon, and it is claimed, with undoubted accuracy, that this is the largest undismembered specimen of a trilobite found in any country.

In the second faunas great Asaphids were not uncommon. As early as 1839 Dr. JOHN LOCKE described in the report of the Geological Survey of Ohio, a portion of an immense pygidium to which he gave the name *Isotelus maximus*. In 1843 Dr. LOCKE figured an entire individual of what he considered the same species, changing the name, however, to *Isotelus megistus*. This specimen measured nine and three-quarters inches in length. The figure was accompanied by outlines of two large pygidia, the greater of which was that referred to in 1839, which, the author says, coincided "with the end of an ellipse 22 inches long and 12 inches broad." This is an evidently much compressed fragment, measuring seven inches in its greatest transverse diameter, and assuming this as the greatest diameter of the pygidium and

restoring the length from the proportions of the animal as there given, the original length of its owner would have been about 13 inches. The plate is incomplete on its anterior portion, and it is probable that the error in this estimate due to the exaggeration of size from compression of the shield, is compensated by the loss of diameter from imperfect retention. This great pygidium, with other large fragments of the same species, were used as a basis for a well-known restoration in plaster to be found in some of the older museums of this country. ANGELIN has given a restoration of *Megalaspis heros* 14 inches in length and BRÖGGER estimated the original length of *Megalaspis acuticauda* to be fully 16 inches. BARRANDE figured an entire *Asaphus nobilis* from Etage D which measures 10½ inches.

Not until the introduction of the genera DALMANITES, HOMALONOTUS and LICHAS do we meet with the most gigantic proportions attained by these crustaceans, and then only after these genera have become well established. Perhaps none of their representatives in the lower Silurian faunas were of commanding size; in the upper Silurian large but not extravagant proportions were sometimes attained. *Lichas Boltoni* of the Niagara fauna, is a magnificent species, one of the largest of its race and remarkable for the frequency with which its parts are found together, an extremely uncommon occurrence in this thin-shelled group. The *Lichas pustulosus* of the Lower Helderberg shaly limestone was a great species attaining a length of 10 inches or more. *Homalonotus delphinôcephalus* of the Niagara fauna grew to large size but does not appear to have attained the length of its successor in the Lower Helderberg, *H. Vanuxemi*, which, according to the restoration from a very large fragment given in the Palæontology of New York, Volume VII (plate V B) grew to a length of at least 11½ inches. SALTER has mentioned (Palæontographical Society, vol. xvii, p. 109) a large fragment of *Homalonotus rudis* which he estimates may have been a foot in length. In later faunas are found traces of this genus of still greater size. Dr. BEUSHAUSEN has figured a pygidium of *H. gigas* from the Spiriferen-sandstein of the Hartz, the possessor of which must have been upward of one foot in length. Unquestionably the largest individual of HOMALONOTUS known is that of *H. major*, from the Oriskany sandstone, figured in the Palæontology of New York, Volume VII (plate V A), a large fragment representing the greater part of the thorax and the pygidium, and according to the restoration there given the original length of the animal must have been well nigh 15 inches. The later and common Hamilton species, *H. DeKayi*, attained no extravagant size though frequently large, e. g. the enrolled individual figured on plate IV (*op. cit.*), the largest entire

specimen reported, which is about 9 inches in length; some large fragments indicate that the animal was sometimes as long as 11 inches.

The size attained by some of the Devonian species of DALMANITES and their immediate predecessors was marvelous. The pygidium of *D. micrurus* figured in the Palæontology of New York, Volume III, page 359 (there given as *D. pleuroptyx*), indicates an individual at least 11 inches in length, and there is reason to believe that the Lower Helderberg species, *D. nasutus* and *D. tridens*, attained a size fully as great. Most remarkable however is the great pygidium of *D. myrmecophorus* of the Corniferous limestone, figured upon plate XV of Volume VII (*op. cit.*), which from the restoration there given, made from careful comparative measurements, would imply an individual 16 inches long.

An interesting feature of the early Devonian trilobitic faunas is the reappearance of CALYMENE in the Schoharie grit and Corniferous limestone, a fact which has been duplicated by the recent description by Dr. OEHLERT of a large species (*C. reperta*), from the lower Devonian of Saint Malo in Angers. The American Devonian species, *C. platys*, is not only the latest but the largest known representative of the genus, and for a group which at its maximum development in species and individuals in the Silurian, rarely attained considerable dimensions, the proportions reached by *C. platys* are especially noteworthy. The entire individuals on plate 1 of Volume VII of the Palæontology show this, and the restoration accompanying a very large pygidium on plate xxv, if accurately drawn, indicates that a length of upward of eight inches was sometimes attained by the species.

No larger or more extravagantly ornamented trilobite than the *Terataspis grandis*, Hall, is known. This giant of its race has left fragments of its test in the Schoharie grit of eastern New York, and in the commingled Schoharie and Corniferous faunas of the Province of Ontario. A very complete illustration and discussion of its different parts, are given in Volume VII of the Palæontology (p. 73, pls. xvii, xviii, xix), and from these one readily obtains an idea of the structure of the cephalon, thorax and abdomen, the free cheeks alone being there unrepresented. There is, however, a very large free cheek in a fragment of Schoharie grit in the collection of the American Museum of Natural History, which in all probability belongs to this species. At the time of the preparation of this volume of the Palæontology of New York, the original specimen of Mr BILLINGS' species *Lichas superbus*, was made accessible for study by the kindness of the Director

of the Geological and Natural History Survey of Canada. This specimen is a portion of the cephalon and a pygidium of *Terataspis grandis*, lying in juxtaposition on the same block, there being no doubt of their having belonged to the same animal. From this specimen it was possible to establish the relative proportions of cephalon and pygidium in this species, and from the data furnished by all the material under study, with careful comparative measurements of entire specimens of *Lichas* in the collections of the State Museum, and of figures of such specimens as have been given by ANGELIN, BARRANDE and SCHMIDT, the accompanying reproduction of the original size of the animal has been drawn, its base being the largest and most complete cephalon figured in the work cited (pl. xvii, fig. 1; xviii, figs. 1, 2).

This restoration gives to the proprietor of this cephalon a length of nearly 20 inches. The figure does not however do full justice to the proportions of the animal. In the cephalon which has served as a base for the restoration the great ovoid central lobe of the glabella has a length of $2\frac{1}{4}$ inches. Mr. BILLINGS speaks of a specimen of *Lichas superbus* in which the length of this lobe was fully 3 inches. If the increase in size of this part was accompanied by the same relative increase in the size of the entire animal (and there is no good reason for assuming the contrary), such a fragment would represent an individual fully 24 inches in length, a size unsurpassed and unequalled by any other known trilobite.

With his extravagant armor of defense and aggression, *Terataspis grandis* must have been easy lord of his invertebrate domain and no very palatable morsel for the heavily plated fishes of his day.

In the genera *Phacops* and *Proetus* great size was never attained. The earlier forms of both of these genera were of inconspicuous proportions and their maximum size was attained in the middle Devonian. An entire *Phacops rana* is figured in the Palæontology of New York, Volume VII, which has a length of 4 inches, and cephalons in the Museum collection indicate an original length of 5 inches, perhaps the greatest size which has been observed in this genus. *Proetus* has a still smaller habit, that is, its maximum size is never so great, and, probably, the largest example of the genus recorded is represented by a cephalon of *Proetus macrocephalus* from the Hamilton group, which belonged to an individual fully $3\frac{3}{4}$ inches in length.

REPORT
OF THE
STATE BOTANIST
1890

REPORT OF THE STATE BOTANIST

To the Regents of the University of the State of New York :

GENTLEMEN.—I have the honor of communicating to you the following report:

Specimens of plants for the State Herbarium have been collected and prepared by the Botanist during the past year in the counties of Albany, Columbia, Cattaraugus, Dutchess, Essex, Greene, Hamilton, Oneida, Oswego, Putnam, Rensselaer, Steuben and Warren.

Specimens contributed by correspondents have been collected in the counties of Dutchess, Onondaga, Ontario, Orleans, Oswego, St. Lawrence and Westchester.

Specimens of 269 species of plants have been added to the Herbarium, of which 254 were collected by the Botanist and 15 were contributed. Of the former 72 are new to the Herbarium, of the latter 11. The number of species represented in the Herbarium has, therefore, been increased by 83. Of the remaining 186 species, the specimens represent forms or varieties not before represented or not well shown, or are specimens intended to accompany the trunk sections now being made of the trees of the State. Among the species not before represented in the Herbarium are 36 species of fungi considered new to science and described as such in another part of this report. A list of the species of which specimens have been added to the Herbarium is marked A.

It seems desirable that the examples of trunk sections of the trees of the State, now being collected, should be accompanied by specimens of a branch or branches bearing the leaves, flowers and fruit. These, when properly labeled, mounted and placed with their respective wood sections, will make the illustration of the character of the tree much more complete and will afford a material aid to the student and the public in acquiring a familiar knowledge of the trees of the State and their names. Specimens have been collected representing 26 species of our trees. The names of these constitute the last 26 names in the list marked A.

Specimens of plants have been contributed by 22 contributors. Among these contributions are many extra limital species not

included in the foregoing enumeration. A list of the contributors and of their respective contributions is marked B.

The record of species not before reported, together with their respective localities, habitats, and time of collection, also remarks concerning them and descriptions of new species, is marked C.

Remarks concerning species previously reported, a record of new localities of rare plants and descriptions of peculiar forms or varieties are contained in a subdivision marked D.

The genus *Tricholoma* is a large one, numbering, according to *Sylloge Fungorum*, 187 species. It is at present represented in this State by 48 species. Some of these are variable in size and color, and others are so similar to each other in general appearance that they are not identified without difficulty. A collation and revision of the descriptions of our New York species and a systematic arrangement of them has seemed desirable. This I have attempted to do, following the plan previously adopted in reference to several other genera of *Agaricini*. Synoptical tables of the different groups of species have been prepared to facilitate the tracing of the species, the descriptions have been revised and in many cases made more complete, and remarks have been added to some of these for the purpose of pointing out more clearly the distinguishing characters. It is believed that these will in nearly all cases enable the student to identify the species with rapidity and accuracy. This monograph of the New York species of *Tricholoma* is marked E.

Mary E. Banning, of Baltimore, Maryland, has for several years been engaged in studying the fleshy fungi of Maryland. Of most of them she has made drawings of the living plant and written descriptions of the species, to which in many cases remarks concerning her own observations of their habits, peculiarities and edible qualities have been added. The figures are beautifully painted by hand in water colors. They are natural size, life-like in expression and accurate in detail. They are on sheets 12 by 15 inches, thus permitting a full size illustration of even the large species. Each plate is devoted to a single species or variety. Generally both the young and the mature plant have been figured and a vertical section of a plant. The specimen has been placed in such positions that both the upper and lower surfaces of the pileus may be seen. Most of the species figured belong to the *Hymenomyces* and *Gasteromyces*. The whole number of species recorded in her list is 179. Of these, 151 have been illustrated on 175 plates, two or more plates being in some instances devoted to one species in

order to show its different varieties. Of the figured species, 14 are described as new. These plates and their accompanying manuscript descriptions have been bound in one large volume with manuscript dedication, preface and index. This volume is one of much value and merit, and though it has evidently cost its author an immense amount of labor and study she has most generously presented it to the New York State Museum, in order that, as she says, it may be kept where it will be the most useful, thereby acknowledging by implication the importance of this institution as a repository and source of mycological information. As a mark of appreciation of this munificent gift it has seemed to me most fitting that this list of Maryland fungi and the descriptions of the new species should be transcribed for publication in this report that they may in this way be made still more accessible to the mycological student and the public. The list with the descriptions of new species is marked F.

I have from time to time recorded in previous reports examples of herbs and shrubs coming under my observation and illustrating the general principle that feeble, starved or unthrifty plants are more liable to the injurious attacks of parasitic fungi than other plants of the same species growing under more favorable circumstances and possessing more vigor. I am able now to cite an illustration of this principle in the attacks of parasitic fungi on trees. Many small spruce trees are growing on the marsh just north of Kasoag, Oswego county. These have a starved, unthrifty appearance. Their growth is very slow and their leaves as a rule are scarcely more than half as long as those of vigorous healthy spruces. Their feeble condition is manifestly due to the character of the soil in which they grow. It is low, wet, undrained and peaty. There is probably a scarcity of the necessary mineral constituents, and the roots of the trees are too much of the time immersed in standing water. In the midst of the marsh, but on higher and therefore better drained land, other spruces grow. These trees are larger, though probably not older, and they have a more vigorous and healthy appearance. Their leaves are of the usual size and color. So far as could be ascertained they are subject to the same conditions, soil excepted, as those that grow in the lower marsh land around them. In July, when I visited this locality, the foliage of the trees in the marsh land was much discolored and badly affected by a parasitic fungus, *Peridermium decolorans*. There was scarcely a tree that had not been invaded by it. At the same time the more vigorous spruces on the higher

land were wholly free from it. The unavoidable conclusion is that their better health and greater vigor afforded them protection against this parasite. Among the noteworthy additions to our State flora may be mentioned a remarkable and very ornamental rarity of the common polypod fern. It is not recorded in Eaton's Ferns of North America, and so far as known it has not before been found in this country. Its botanical name is *Polypodium vulgare* L. var. *cristatum*, Lowe. Because of its singular character and its rarity I have given a figure and a more full account of it in its appropriate place in this report.

A new fungus of special interest, because of its peculiar habitat, has also been brought to light. It is a species of mold which I have called *Aspergillus aviarius*. It was found inside the body of a canary bird, the death of which it apparently caused. It helps to illustrate the fact that there is scarcely a place in which or a substance on which fungi of some sort may not grow. A full description of this species has been given in another place.

Very respectfully

CHAS. H. PECK

ALBANY, November 29, 1890

A

PLANTS ADDED TO THE HERBARIUM

New to the Herbarium

- Ranunculus circinatus* *Sibth.*
Lychnis Floscuculi *L.*
Spiræa sorbifolia *L.*
Rosa cinnamomea *L.*
Prunus Persica *L.*
Pyrus Aucuparia *Gært.*
Epilobium glandulosum *Lehm.*
Digitalis purpurea *L.*
Clintonia umbellata *Torr.*
Buxbaumia indusiata *Brid.*
Lejeunia calcarea *Lib.*
Frullania dilatata *Nees.*
Armillaria viscidipes *Pk.*
Tricholoma grande *Pk.*
T. sordidum *Fr.*
Clitocybe rivulosa *Pers.*
C. fuscipes *Pk.*
Collybia expallens *Pk.*
Mycena pseudopura *Cke.*
Omphalia corticola *Pk.*
Pleurotus pubescens *Pk.*
P. campanulatus *Pk.*
Flammula squalida *Pk.*
Pluteolus reticulatus *Pers.*
Crepidotus distans *Pk.*
Cortinarius albidus *Pk.*
Hygrophorus penarius *Fr.*
Coprinus picaceus *Fr.*
Polyporus annosus, *Fr.*
Dædalea sulphurella *Pk.*
D. extensa *Pk.*
Hydnum caput-ursi *Fr.*
H. arachnoideum *Pk.*
Odontia tenuis *Pk.*
Mucronella minutissima *Pk.*
Thelephora odorifera *Pk.*
Porothelium fimbriatum *Fr.*
Cyphella arachnoidea *Pk.*
Geaster rufescens *Pers.*
Phyllosticta Ludwigiae *Pk.*
Phoma sordida *Sacc.*
Dothiorella Celtidis *Pk.*
- Sphæropsis Ellisii* *Sacc.*
S. rubicola *C. & E.*
Diplodia Liriodendri *Pk.*
D. multicarpa *Pk.*
Hendersonia epileuca *B. & C.*
Septoria Pteridis *Pk.*
Melanconium zonatum *E. & E.*
Septomyxa Carpini *Pk.*
Pestalozzia lignicola *Cke.*
Puccinia Spargulæ *DC.*
Doassansia Sagittariæ *Fisch.*
Aspergillus aviarius *Pk.*
Sporotrichum Lecanii *Pk.*
Diplosporium breve *Pk.*
Didymaria Ungerii *Cd.*
Ramularia destruens *Pk.*
R. Junci *Pk.*
R. graminicola *Pk.*
R. Heraclei *Sacc.*
Cercospora Veratri *Pk.*
Bispora effusa *Pk.*
Cladosporium entoxylinum *Cd.*
Septonema episphæricum *Pk.*
Coniothecium effusum *Cd.*
Epicoecum vulgare *Cd.*
E. diversisporum *Preuss.*
Valsa microstoma *Fr.*
V. coöperta *Cke.*
Eutypella cerviculata *Sacc.*
Diaporthe binoculata *Sacc.*
D. tuberculosa *Sacc.*
D. rostellata *Nitsch.*
D. Americana *Speg.*
Massaria epileuca *B. & C.*
Caryospora minor *Pk.*
Metasphæria nuda *Pk.*
Pleospora Asparagi *Reb.*
Lophiostoma vagans *Fab.*
Stictis minuscula *Karst.*
Pseudopeziza Pyri *Pk.*
Saccharomyces Betulæ *Pk. & Pat.*

Not new to *the* Herbarium

- Ranunculus secleratus* L.
R. ambigens Wats.
Thalictrum purpurascens L.
Cimicifuga racemosa Nutt.
Nymphaea odorata Ait.
Corydalis flavula DC.
Dicentra cucullaria DC.
Sanguinaria Canadensis L.
Viola sagittata Ait.
Brassica campestris L.
Raphanus sativus L.
Lechea minor L.
Stellaria media Sm.
Lychnis vespertina Sibth.
Linum Virginianum L.
Rubus villosus Ait.
R. hispidus L.
R. triflorus Rich.
Potentilla tridentata Ait.
Spiraea salicifolia L.
Nesaea verticillata H. B. K.
Oenothera pumila L.
Sedum ternatum Mx.
Heuchera Americana L.
Cicuta maculata L.
C. bulbifera L.
Angelica hirsuta L.
Aralia racemosa L.
Galium triflorum Mx.
Viburnum pauciflorum Pyle.
Symphoricarpos racemosus Mx.
Solidago sempervirens L.
S. nemoralis Ait.
S. arguta Ait.
Aster macrophyllus L.
A. Novæ-Angliæ L.
A. undulatus L.
A. sagittifolius Willd.
A. multiflorus Ait.
A. paniculatus Lam.
A. Novi-Belgii L.
A. prenanthoides Muhl.
A. vimineus Lam.
Senecio vulgaris L.
Erigeron Canadensis L.
Cacalia suaveolens L.
C. atriplicifolia L.
Antennaria plantaginifolia Hook.
Prenanthes septentraria Pursh.
Rudbeckia triloba L.
Lobelia spicata Lam.
Plantago lanceolata L.
Verbascum Blattaria L.
V. Lychuitis L.
Geraardia tenuifolia Vahl.
Stachys aspera Mx.
Monarda didyma L.
Pycnanthemum lanceolatum Pursh.
Brunella vulgaris L.
Myosotis laxa Lehm.
Onosmodium Virginianum DC.
O. Carolinianum DC.
Phlox maculata L.
Gentiana linearis Frœl.
Asclepias phytolaccoides Pursh.
Vincetoxicum nigrum Mœnch.
Lycium vulgare Dunal.
Rumex obtusifolius L.
R. crispus L.
Polygonum hydropiperoides Mx.
Fraxinus pubescens Lam.
Calla palustris L.
Typha latifolia L.
Alisma Plantago L.
Smilax herbacea L.
Epipactis Helleborine Crantz.
Calopogon pulchellus R. Br.
Chamaelirium Carolinianum Willd.
Habenaria psycodes Gray.
Juncus effusus L.
J. filiformis L.
J. acuminatus Mx.
J. marginatus Rostk.
Scirpus Smithii Gray.
S. atrovirens Muhl.
Eriophorum gracile Koch.
E. Virginicum L.
Eleocharis intermedia Schultes.
Carex folliculata L.
C. monile Tuck.
C. retrorsa Schw.
C. crinita Lam.
C. triceps Mx.
C. flava L.
C. laxiflora Lam.
C. Tuckermanni Dew.
C. vulpinoidea Mx.
C. vitilis Fr.
C. straminea Willd.
C. lupulina Muhl.
C. utriculata Boott.
Phalaris arundinacea L.

- Bromus secalinus L.*
B. ciliatus L.
Asprella Hystrix Willd.
Polypodium vulgare L.
Equisetum hyemale L.
Riccia fluitans, L.
Amanita rubescens Fr.
Lepiota rhacodes Vitt.
Tricholoma Peckii Howe.
T. terreum Schæff.
T. album Schæff.
T. chrysenteroides Pk.
Clitocybe cyathiformis Fr.
Collybia velutipes Curt.
C. Familia Pk.
Mycena pterigena Fr.
Pleurotus applicatus Batsch.
P. sulphureoides Pk.
P. striatulus Fr.
Entoloma cyaneum Pk.
Pholiota discolor Pk.
Hebeloma crustuliniforme Bull.
Flammula spumosa Fr.
Crepidotus dorsalis Pk.
Agaricus silvicola Vitt.
Stropharia squamosa Fr.
Psilocybe spadicea Fr.
Cortinarius collinitus Fr.
Hygrophorus splendens Pk.
H. pratensis Fr.
Lactarius atroviridis Pk.
Russula variata Banning.
Cantharellus lutescens Fr.
Polystictus conchifer Schw.
Poria sanguinolenta Fr.
Dædalea unicolor Fr.
Irpex Tulipiferae Schw.
Craterellus clavatus Fr.
Stereum bicolor Fr.
S. ochraceoflavum Schw.
Corticium Oakesii B. & C.
Coniophora puteana Fr.
Tremella mesenterica Retz.
Comatricha Friesiana Rost.
Enerthenema papillatum Rost.
Doassansia Alismatis Corn.
Cercospora varia Pk.
Ramularia lineola Pk.
R. variabilis Fckl.
Zygodesmus fuscus Cd.
Bactridium flavum K. & S.
Gloeosporium lagenarium Pass.
Tuberculina persicina Sacc.
Underwoodia columnaris Pk.
Vibrissea truncorum Fr.
Peziza chlora Schw.
Propolis faginea Karst.
Melogramma vagans DeNot.
Magnolia acuminata L.
Acer rubrum L.
Amelanchier Canadensis T. & G.
Ulmus fulva Mx.
U. Americana L.
Celtis occidentalis L.
Morus rubra L.
Platanus occidentalis L.
Nyssa sylvatica Marsh.
Fraxinus pubescens Lam.
Carya amara Nutt.
Betula lenta L.
B. lutea Mx.
B. populifolia Ait.
B. papyrifera Marsh.
B. nigra L.
Quercus alba L.
Q. macrocarpa Mx.
Q. rubra L.
Q. coccinea Wang.
Q. palustris DuRoi.
Fagus ferruginea Ait.
Populus monilifera Ait.
Pinus resinosa Ait.
Thuya occidentalis L.
Juniperus Virginiana L.

(B)

CONTRIBUTORS AND THEIR CONTRIBUTIONS

- Mrs. E. C. Anthony, Gouverneur, N. Y.
Geaster rufescens Pers. | *Tulostoma mammosum Fr.*
 Mrs. L. L. Goodrich, Syracuse, N. Y.
Epipactis Helleborine Crantz. | *Selaginella apus Spring,*
 Mrs. E. B. Smith, Coeymans, N. Y.
Xylaria Hypoxylon var. pedata Fr.

Mrs. W. H. Fitch, Norwich, N. Y.

*Aconitum Noveboracense Gr.**Cacalia suaveolens L.**Liatris spicata Willd.**Erythronium albidum Nutt.*

Miss P. A. McCabe, White Plains, N. Y.

*Caucalis Anthriscus Huds.**Pentstemon navigatus Soland.*

Mrs. E. G. Britton, New York, N. Y.

*Andreea petrophila Ehrh.**Timmia austriaca Hedw.**Georgia geniculata Girg.**Scouleria aquatica Hook.**G. pellucida Rabh.**Catharinea Selwyni Britton.**Fissidens rufulus B. & S.**Bartramia Menziesii Turn.**F. grandifrons Brid.**B. Oederiana Sw.**F. Hallianus Mitt.**B. pomiformis Hedw.**Dicranum strictum Schleich.**Philonotis fontana Brid.**D. Starkii W. & M.**Neckera pennata Hedw.**D. fuscescens Turn.**Climacium Americanum Brid.**Dicranella crispa Schp.**C. dendroides W. & M.**D. secunda Lindb.**Hypnum riparium L.**Blindia acuta B. & S.**H. proliferum L.**Hedwigia ciliata Ehrh.**H. crista-castrensis L.**Orthotrichum cupulatum Hoffm.**H. megaptitulum Sull.**Leucobryum vulgare Hampe.**Alsia abietina Sull.**Grimmia heterosticha C. & M.**Thamnum Bigelovii Sull.**G. canescens C. & M.**Plagiothecium latebricola Lindb.**G. patens B. & S.**P. turfatum Lindb.**G. hypnoides Lindb.**P. Mullerianum, Schp.**G. torquata Hornsch.**P. elegans Schp.**G. apocarpa Hedw.**Rhytidium robustum Hook.**Braunia Californica Lesq.**Hylocomium triquetrum B. & S.**Anæctangium Lapponicum Hedw.**H. squarrosum B. & S.**A. Mougeottii Lindb.**H. loreum B. & S.**Swartzia montana Lindb.**H. parietinum Lindb.*

Miss M. E. Banning, Baltimore, Md.

Lycoperdon caelatum Bull.

W. M. Beauchamp, Baldwinsville, N. Y.

Nicotiana rustica L.

Smith E. Jelliffe, M. D., Brooklyn, N. Y.

*Atrichum crispum James.**Homalia trichomanoides B. & S.**Neckera oligocarpa B. & S.**Asplenium montanum Willd.*

Thomas Taylor, M. D., Washington, D. C.

*Rhizopogon rubes. v. Vittadini Tul.**Calostoma Berkeleyi Massee.*

W. W. Rowlee, Ithaca, N. Y.

*Ranunculus circinatus Sibth.**Spiræa sorbifolia L.*

Moses Craig, Ithaca, N. Y.

*Æcidium Euphorbiæ Gmelin.**Puccinia Menthae Pers.**Æ. gnaphaliatum Schw.**P. coronata Cd.**Æ. Caladii Schw.**P. Podophylli Schw.**Æ. Iridis Ger.*

C. L. Shear, Stockbridge, Mass.

Lychnis Floscuculi L.

S. C. Bradt, Albany, N. Y.

Æcidium Clematidis DC.

Arthur Claghorn, New Harbor, Newfld.

Empetrum nigrum L.

Charles A. Coons, Valatie, N. Y.

Polypodium vulgare L., var. *cristata* Lowe.

Rev. F. D. Kelsey, Helena, Mont.

Omphalodes Howardi Gr.*Douglasia montana* Gr.*Lithospermum angustifolium* Mx.*Phragmidium subcorticium* Wint.*Puccinia Grindeliæ* Pk.P. *Tanaceti* DC.P. *flosculosorum* Ræhl.P. *Phragmitis* Korn.*Uromyces Spragueæ* Hark.U. *Trifolii* Lev.*Æcidium Glaucis* D. & M.Æ. *Plantaginis* Ces.Æ. *gaurinum* Pk.*Melampsora Epilobii* Wint.*Melampsorella Cerastii* Schr.*Exidia glandulosa* Fr.*Cucurbitaria Kelseyi* E. & E.*Ramularia arnicalis* E. & E.*Entyloma compositarum* Farl.*Phoma Mamillariæ* Web.*Asteroma ribicolum* E. & E.*Dimerosporium Populi* E. & E.*Valsa nivea* Fr.V. *boreëlla* Karst.*Uncinula adunca* Lev.*Phyllactinia suffulta* Sacc.*Erysiphe communis* Wallr.E. *Cichoracearum* DC.

C. E. Fairman, M. D., Lyndonville, N. Y.

Pleurotus pubescens Pk.*Diplodia spiræicola* E. & E.*Pestalozzia insidens* Zab.*Melanconium zonatum* E. & E.*Coniosporium Fairmani* Sacc.*Cyphella Tiliæ* Cke.*Tubulina cylindrica* Bull.*Fenestella amorphæ* E. & E.*Cenangium rubiginellum* Sacc.

L. M. Underwood, Syracuse, N. Y.

Corydalis flavula DC.*Riccia fluitans* L.R. *lutescens* Schw.R. *Donnellii* Aust.R. *crystallina* L.*Preissia hemisphærica* Cogn.*Notothylas orbicularis* Sulliv.*Lunularia vulgaris* Mich.*Fimbriaria tenella* Nees.*Thallocarpus Curtisii* Lindb.*Aneura pinguis* Dum.A. *pinnatifida* Nees.A. *latifrons* Lindb.A. *multifida* Dum.*Pellia epiphylla* Nees.P. *endivæfolia* Dum.*Fossombronia Dumortieri* Lindb.*Metzgeria conjugata* Lindb.M. *pubescens* Rad.*Lejeunia calcarea* Lib.*Lejeunia clypeata* Sulliv.*Frullania Eboracense* Gott.F. *Virginica* Lehm.F. *Bolanderi* Aust.F. *Oakesiana* Aust.F. *dilatata* Nees.*Radula spicata* Aust.R. *tenax* Lindb.*Porella Bolanderi* Aust.P. *platyphylla* Lindb.P. *navicularis* Lindb.*Blepharostoma tricophylla* Dum.*Ptilidium Californicum* Aust.*Bazzania deflexa* Mart.*Chiloscyphus polyanthos* Cd.*Lophocolea heterophylla* Nees.L. *Leibergii* Under.*Odontoschisma Sphagni* Dum.*Harpanthus scutatus* Spruce.*Jungermannia setiformis* Ehrh.

Jungermannia barbata Schreb.
 J. *minuta Crantz.*
 J. *inflata Huds.*
 J. *incisa Schrad.*
 J. *exsecta Schmidt.*
Cephalozia multiflora Spruce.
 C. *divaricata Dum.*
 C. *bicuspidata Dum.*
 C. *Virginiana Spruce.*
Mylia Taylori Gray.
Diplophyllum albicans Dum.
Gymnomitrium concinnatum Cd.
Scapania undulata N. & M.

Scapania Bolanderi Aust.
 S. *glaucocephala Aust.*
Nardia crenulata Lindb.
 N. *fossombronioides Lindb.*
Marsupella emarginata Dum.
 M. *sphacelata Dum.*
Sphaerocarpus terrestris Mich.
 S. *Donnellii Aust.*
Polyporus fuscocarnaeus Pers.
Thelephora odorifera Pk.
Peniophora unicolor Pk.
Underwoodia columnaris Pk.

J. Dearness, London, Can.

Phyllosticta Apocyni Trel.
 P. *variegata E. & E.*
Ascochyta Thaspii E. & E.
Melasmia Galii E. & E.
Steganosporium cellulosum Cd.
 S. *pyriforme Hoffm.*
Physoderma Menyanthis DeBy.
Puccinia microsperma E. & E.
Boletus spectabilis Pk.

Septoria Kalmiae C. & E.
 S. *bacilligera Wint.*
 S. *carnea E. & E.*
 S. *Dearnessii E. & E.*
Ramularia Solidaginis E. & E.
 R. *stolonifera E. & E.*
Gnomonia fimbriata Pers.
Asterina rubicola E. & E.

S. M. Tracy, Agricultural College, Miss.

Uredo Fici Cast.
Phragmidium subcorticium Wint.
Puccinia Anthoxanthi Fekl.
 P. *solida Schw.*
 P. *emaculata Schw.*
 P. *fragilis Tr. & G.*
 P. *Lobeliae Ger.*
 P. *Malvacearum Mart.*
 P. *rubigovera Wint.*
 P. *Smilacis Schw.*
 P. *Sporoboli Arth.*
Uromyces Trifolii Lev.
 U. *Spermococes Cast.*
 U. *Dactylidis Othl.*
 U. *solida B. & C.*
 U. *appendiculatus Lev.*
Ustilago Buchloes E. & Tr.
 U. *Syntherismae Schw.*
Cintractia Avenae E. & Tr.
Sorosporium Everhartii E. & G.
Cronartium asclepiadeum Fr.
Melampsora Quercus Schraet.
 M. *Gleditschiae E. & E.*
 M. *Hydrangeae Burrill.*

Æcidium Epilobii DC.
Peridermium orientale Cke.
Phyllosticta hortorum Speg.
Staganospora Cyperi E. & Tr.
Stigmina Platani Fekl.
Scolecotrichum graminis Fekl.
Helminthosporium fumosum E. & M.
 H. *Ravenelii B. & C.*
Sphacelotheca hydropiperis DeBy.
Cercospora grisea C. & E.
Cercospora persica Sacc.
Fusarium Celtidis E. & Tr.
Peronospora Halstedii Farl.
Stictis heliotricha E. & E.
Pseudopeziza Medicaginis Lib.
Erysiphe Liriodendri Schw.
Uncinula macrospora Pk.
 U. *polychæta B. & C.*
Microsphaeria quercina Burrill.
Acospermum compressum Tode.
Ascomyces Quercus Cke.
Parodiella perisporioides B. & C.
Phyllachora Solidaginis Schw.

E. B. Southwick, New York, N. Y.

Aspergillus aviarius Pk.

(C)

SPECIES OF PLANTS NOT BEFORE REPORTED

Ranunculus circinatus *Sibth.*

Black creek, near Fulton, Oswego county. July. *W. W. Rowlee.*

Cardamine flexuosa *With.*

Cascadeville, Essex county. June. The plant here noted was formerly referred to *C. hirsuta* var. *silvatica*, but it differs so much from *C. hirsuta* that I am disposed to follow Withering, in considering it a distinct species.

Lychnis Floscuculi *L.*

Irvington, Westchester county. *C. L. Shear.* This is an introduced plant, and has probably escaped from cultivation.

Spiræa sorbifolia *L.*

Escaped from cultivation and established by roadsides and in a pasture near Fulton. July. *Rowlee.*

Rosa cinnamomea *L.*

Morehouseville, Hamilton county. July. This rose which has been introduced into this country and cultivated, is frequently found growing by roadsides or in adjoining fields. It often persists long after the houses, near which it was planted, have disappeared. It spreads somewhat by its roots, but probably does not spread by seed. The flowers are usually double.

Prunus Persica *L.*

Warsaw, Wyoming county; Turners, Orange county; Cold Spring, Putnam county. Also in Cayuga county. *W. R. Dudley.* In the three localities first mentioned the trees appear to have grown spontaneously, and were fruiting.

Pyrus Aucuparia *Gært.*

Schoharie; Delmar, Albany county, and Spencertown, Columbia county. Sometimes escaping from cultivation and growing wild in the borders of fields or woods.

Epilobium glandulosum *Lehm.*

Wet places, Schroon river, Essex county. August.

Epilobium adenocaulon *Hauask.*

Catskill mountains. In the Thirty-third Report this was reported as a form of *E. coloratum*; but it is now raised to specific rank.

Digitalis purpurea *L.*

Morehouseville, July. The foxglove is a highly ornamental plant, and sometimes escapes from cultivation and becomes established in fields and pastures. In the locality mentioned it was growing in a meadow and an adjoining pasture. About half the plants bore pure white flowers. The lower leaves of some of the plants were spotted by a parasitic fungus, *Ramularia variabilis*.

Buxbaumia indusiata *Brid.*

Decaying wood. Catskill mountains. October.

Lejeunea calcarea *Lib.*

Bark of cedar trees. Farmington, Ontario county. *L. M. Underwood.*

Frullania dilatata *Nees.*

Bark of trees. Marcellus, Onondaga county. *Underwood.*

Armillaria viscidipes *n. sp.*

(Plate 2, Figs. 1 to 3.)

Pileus fleshy, compact, convex or nearly plane, glabrous, whitish with a slight yellowish or reddish-yellow tint, flesh white, odor peculiar, penetrating, subalkaline; lamellæ narrow, crowded, sinuate or subdecurrent, whitish; stem equal, solid, viscid and slightly tinged with yellow below the narrow membranous annulus, whitish above; spores elliptical .0003 in. long .0002 broad.

Pileus 3 to 6 in. broad; stem 3 to 4 in. long, 6 to 12 lines thick.

In mixed woods. Rock City, Dutchess county. October.

This is the fourth species of *Armillaria* found in the State. It is a large, fine fungus, easily known by its white and yellowish hues, its crowded lamellæ, viscid stem and peculiar penetrating almost alkaline odor. The cuticle of the pileus is thin and soft to the touch, but it sometimes cracks longitudinally and is sometimes slightly adorned with innate fibrils. *A. delhiscens* is said to have a viscid stem, but it is also squamose and the pileus is yellowish ochraceous.

Tricholoma grande *n. sp.*

(Plate 3, figs. 5 to 8.)

Pileus thick, firm, at first hemispherical, then convex, often irregular, dry, squamulose, somewhat silky-fibrillose toward the margin which is at first involute, white, flesh grayish-white, taste

farinaceous; lamellæ close, rounded behind, adnexed, white; stem stout, solid, fibrillose, at first tapering upward, then equal or but slightly thickened at the base, pure white; spores elliptical, .00035 to .00045 in. long, .00024 broad.

Pileus 4 to 5 in. broad; stem 2 to 4 in. long, 1 to 1.5 in. thick.

Among fallen leaves in woods. Carrollton, Cattaraugus county. September.

The plants are often caespitose and then the pileus is more or less irregular and the lamellæ somewhat transversely lacerated. The species is related to *T. Columbetta* from which its larger size, constantly squamulose pileus, more caespitose mode of growth, larger spores and farinaceous taste separate it. Its edible quality was tested but its flesh is not tender nor its flavor captivating even in young specimens.

The young margin is pure white and both it and the upper part of the stem are sometimes studded with drops of moisture. The squamules of the pileus are brownish.

***Tricholoma sordidum* Fr.**

Manured ground. Menands, Albany county. May.

***Clitocybe rivulosa* Pers.**

In woods. Morehouseville, Hamilton county. July.

Our specimens were rather deeply umbilicate, with narrow lamellæ. In other respects they agree with the description of this species. The abundant branching radicating strings of mycelium bind the earth in a mass at the base of the stem.

***Clitocybe fuscipes* n. sp.**

Pileus thin, broadly convex or plane, umbilicate, glabrous, whitish and striatulate when moist, pure white when dry, odor and taste farinaceous; lamellæ nearly plane, subdistant, adnate or slightly decurrent, white; stem equal, glabrous or slightly mealy at the top, hollow, fuscous when moist, paler when dry; spores globose, .0002 to .00024 in. broad.

Pileus 4 to 8 lines broad; stem about 1 in. long.

Under pine trees. Carrollton. September.

Apparently allied to *C. pithyophila* but a much smaller plant with a farinaceous odor and a stem darker in color than the pileus or lamellæ. The stem often appears stout in proportion to the size of the pileus.

Collybia expallens n. sp.

Pileus thin, broadly convex, then plane, centrally depressed, glabrous, hygrophanous, watery-brownish and striatulate on the thin margin when moist, whitish when dry, flesh whitish when dry, odor farinaceous; lamellæ rather broad, subdistant, rounded behind, adnexed, whitish subcinereous or dingy-yellowish; stem short, hollow, equal or slightly thickened at the base, spores broadly elliptical, .0002 in. long, .00016 broad.

Pileus 1 to 2 in. broad; stem about 1 in. long, 2 lines thick.

Among fallen pine leaves in woods. Salamanca, Cattaraugus county. September.

The pileus is very much paler when dry than it is when moist. When fresh the stem is adorned with delicate fibrils or flocci, but these soon vanish or disappear with a touch. In drying, the moisture disappears from the disk first, the margin last. The farinaceous odor is very distinct. The attachment of the lamellæ easily distinguishes this plant from similar species of *Clitocybe*.

Mycena pseudopura Oke.

Woods. Salamanca. September.

Omphalia corticola n. sp.

(Plate 2, figs. 8 to 12.)

Pileus thin, submembranous, convex, becoming expanded and umbilicate, distantly striate, whitish or pale cinereous; lamellæ narrow, distant, at first arcuate and adnate, then decurrent, white; stem short, curved, sprinkled with mealy particles, at first whitish with a brown base, then wholly brown or whitish at the top only; spores elliptical, .0003 in. long, .00016 broad, generally uninucleate.

Pileus 2 to 4 lines broad; stem 4 to 6 lines long.

Bark of living oak trees, *Quercus alba*. Carrollton. September.

This species closely resembles *Mycena corticola*, from which it is separated by its paler pileus, narrower and at length decurrent lamellæ and elliptical spores. Its mode of growth is the same as in that species.

Pleurotus pubescens n. sp.

Pileus fleshy, convex, suborbicular, pubescent, yellowish; lamellæ broad, subdistant, rounded behind, sinuate, pallid tinged with red; stem short, firm, curved, eccentric, colored like the pileus; spores globose .0003 in. broad.

Pileus about 2 in. broad; stem scarcely 1 in. long.

Trunks of trees. Lyndonville. C. E. Fairman.

This is a species which in some respects approaches *P. Ruthæ*, but differs from it in having the lamellæ distinct behind, not anastomosing, and there are no red tints on the stem. The plant is said to be fragrant when fresh. I have seen it only in the dried state and, therefore, the description may not correspond exactly with the coloring of the fresh plant.

Pleurotus campanulatus *n. sp.*

(Plate 2, figs. 13 to 15.)

Pileus thin, subtenacious, campanulate, attached by the vertex, glabrous or sprinkled with a few grayish hairs, often plicate-striate on the margin, black; lamellæ few, distant, whitish; spores curved, .0003 to .00035 in. long, .00015 to .00016 broad.

Pileus 1 to 2 lines broad.

Dead branches of mulberry, *Morus rubra*. Saugerties. May.

This fungus resembles some forms of *P. striatulus*, but it is easily distinguished by its black color and curved spores. The vertex of the pileus is sometimes prolonged, forming a distinct stem.

Flammula squalida *n. sp.*

Pileus fleshy, convex or plane, firm, viscose, glabrous, dingy-yellowish or rufescent, flesh whitish, colored similar to the pileus under the separable pellicle; lamellæ rather broad, adnate, pallid, becoming brownish-ferruginous; stem slender, generally flexuous, hollow, fibrillose, subcartilaginous, pallid or brownish, pale-yellow at the top when young; spores brownish-ferruginous, .0003 in. long, .00016 broad.

Pileus 1 to 1.5 in. broad; stem 1.5 to 3 in. long, 1 to 2 lines thick.

In bushy and swampy places. Carrollton and Sandlake. September.

This species is closely allied to *F. spumosa*, of which, perhaps, some may prefer to consider it a variety. But having observed it several times in different localities and always finding it constant in its character and readily distinguishable, it has seemed best to recognize it as a species. It is distinguished by its slender habit, more uniform color, subcartilaginous stem, darker spores and generally dingy appearance. It is often strongly caespitose and is found especially among alder bushes in swamps.

Pluteolus reticulatus *Pers.*

Decayed wood of deciduous trees. Carrollton. September.

Crepidotus distans *n. sp.*

(Plate 2, figs. 4 to 7.)

Pileus membranous, convex, distantly sulcate-striate, minutely pubescent, tawny; lamellæ broad, ventricose, very distant, adnate, colored like the pileus; stem minute, eccentric, reddish-brown; spores elliptical, .0004 to .0005 in. long, .00025 to .0003 broad.

Pileus 2 to 4 lines broad; stem about 1 line long.

Bark of thorn tree, *Crataegus tomentosa*. Carrollton. September.

A small species, very rare and easily overlooked, but very distinct by its color, its pubescent pileus and very distant lamellæ.

Cortinarius albidus *n. sp.*

(Plate 3, figs. 1 to 4.)

Pileus fleshy, convex or nearly plane, viscid, white, sometimes slightly tinged with yellow, flesh white; lamellæ close, emarginate, at first whitish, then cinnamon color; stem equal, solid, white, with a depressed oblique submarginate bulb at the base, veil white; spores subelliptical, .0004 to .00045 in. long, .00024 broad.

Pileus 2 to 4 in. broad; stem 2 to 4 in. long, 4 to 8 lines thick.

Thin woods. Carrollton. September.

Related to *C. multiformis* from which it is separable by its color, which is entirely white except in the mature lamellæ, and by its peculiar oblique bulb. Its spores also are longer and of a different shape.

Hygrophorus penarius *Fr.*

Mixed woods. Voorheesville. October.

Our specimens differ slightly in color from the typical form. They are white slightly stained with yellow and they retain their color in drying. Some of them are very large, the pileus being five or six inches broad.

Coprinus picaceus *Fr.*

Decaying trunks or branches of trees in woods. Lyndonville. June. *Fairman*.

The form here referred to this species differs somewhat from the description of the type in being smaller, in having no bulb to the stem and in having smaller spores. It is probably the "smaller variety growing on rotten wood" noticed by Stevenson in his *British Fungi*. I have seen the true form of the species from Kansas. The New York plant seems to me to be worthy of distinctive designation, at least as a variety, and I call it

Var. *ebulbosus*. Plant smaller; stem destitute of a bulb; spores .0003 to .0004 in. long, .0002 broad.

Polyporus annosus Fr.

Decaying wood. Salamanca. September.

This is evidently a very rare species in our State.

Dædalea sulphurella n. sp.

Resupinate, effused or nodulose, pale sulphur yellow; pores short, labyrinthiform, the dissepiments often lacerated and irpiciform in the dry plant; pores subglobose or broadly elliptical, .0002 in. long.

Much decayed wood. Salamanca. September.

Mostly very irregular or nodulose, following the irregularities of the wood and encrusting mosses. It is of a beautiful pale yellow color when fresh, but it changes to a dull pallid hue when dry.

Dædalea extensa n. sp.

Resupinate, thick, coriaceous, often uneven or somewhat nodulose, the margin at first cottony and white, soon changing to brown, the subiculum slightly rufescent; pores large, unequal and labyrinthiform, in vertical places oblique, whitish; spores minute, oblong, .00024 to .0003 in. long, .0001 to .00012 broad.

Prostrate trunks of deciduous trees. Salamanca. September.

This forms patches two feet or more in length on the sides and lower surface of the trunk. It follows the inequalities of the surface, and in vertical places it becomes more or less nodulose or develops a thick obtuse margin, which is velvety-tomentose and at length dark-brown in color, but I have seen no reflexed margin. It is suggestive of resupinate forms of *Trametes mollis*, but differs from it in the character of the pores in the thicker subiculum and in the absence of any free margin.

Hydnum caput-ursi Fr.

Decaying birch wood, *Betula lutea*. Carrollton. September.

Hydnum arachnoideum n. sp.

Resupinate; subiculum effused, very thin, webby or cottony, white; aculei minute, short, conical, unequal, scattered or sometimes crowded, whitish; mycelium often forming slender branching white radicular strings that creep over or permeate the matrix; spores minute, globose, .00016 in. broad.

Much decayed wood of hemlock, *Tsuga Canadensis*. Salamanca. September.

It seems to be closely related to *H. Micheneri*, but separated from it by the conical aculei. In this species also they are sometimes crowned with one to four cilia. The specific name has reference to the character of the subiculum.

***Odontia tenuis* n. sp.**

Effused, very thin, tender, dry, pallid, the margin not clearly fimbriate; verrucae minute, scarcely visible to the naked eye, subglobose or oblong, scattered or crowded, sometimes entire; mycelium sometimes collected into dingy-yellowish branching slender threads.

Much decayed wood of birch, *Betula lutea*. Salamanca. September.

In texture and structure this resembles *Odontia fusca*, in color, *O. fimbriata*.

***Mucronella minutissima* n. sp.**

Aculei very minute, about one-sixth of a line long, gregarious, subulate, white; spores minute, elliptical, .00016 in. long, .0001 broad.

Decaying oak wood. Clarksville, Albany county. September.

This species is so minute that it is scarcely visible to the naked eye. The measurement of the aculei here given was taken from the dried specimen. In the fresh plant it would probably be a little greater.

***Thelephora odorifera* n. sp.**

Pilei 8 to 12 lines broad, caespitose, subcoriaceous, subdimidiate, imbricated, fibrous-tomentose, dingy-whitish or grayish; hymenium even, not polished, concolorous; stems short or none; spores globose, echinulate, colored, .0003 to .00035 in. broad.

Rich soil under cedar trees. Jamesville. July. *Underwood*,

The species is apparently related to *T. intybacea*, but it differs from that fungus in its paler color, smooth hymenium and larger spores. The specimens at first were quite fragrant, but the odor was lost after a few weeks.

***Porotheium fimbriatum* Fr.**

Decaying wood. Carrollton. September.

***Cyphella arachnoidea* n. sp.**

Irregularly cupular, unequal, very thin, membranous, tender, minutely downy externally, pure white, the hymenium in large specimens somewhat uneven; spores subglobose, .00016 to .0002 in. long, .00016 broad.

Cups 1 to 2 lines broad, seated upon or developing from fine white loosely branching webby strings of mycelium.

Bark and mosses. Carrollton. September.

The specific name has reference to the character of the mycelium, by which the species may easily be recognized.

Geaster limbatus Fr.

Caldwell, Warren county. June. The specimens were old, but appear to belong to this species.

Geaster rufescens Pers.

Gouverneur, St. Lawrence county. Mrs. E. C. Anthony.

Phyllosticta Ludwigiae n. sp.

(Plate 4, figs. 22 and 23.)

Spots small, orbicular, sometimes confluent, centrally pallid, dry, surrounded by a brownish or purplish-red border; perithecia few, often single, epiphyllous, .004 in. broad, black; spores elliptical or oblong, binucleate, colorless, .0003 to .00035 in. long, .00016 broad.

Living leaves of water purslane, *Ludwigia palustris*. Selkirk. July.

Phoma sordida Sacc.

Dead twigs of water beech, *Carpinus Americana*. Cemetery, Albany county. May.

Dothiorella Celtidis n. sp.

Stroma small, depressed, suborbicular, seated on the inner bark, erumpent; perithecia immersed in the stroma; spores oblong, obovate or subfusiform, often binucleate or trinnucleate, colorless, .0008 to .001 in. long, .0003 to .00035 broad, sometimes oozing out in a whitish mass.

Dead branches of hackberry, *Celtis occidentalis*. Saugerties. May.

Sphæropsis Ellisii Sacc.

Dead corticated branches of tamarack, *Larix Americana*. Kasoag, Oswego county. July.

Var. *Laricis*. Perithecia larger, about .014 in. broad, often arranged in rows and surrounded by the whitish ruptured epidermis; spores .0012 to .0018 in. long, .0006 to .0008 broad.

Sphæropsis rubicola C. & E.

Dead stems of blackberry, *Rubus villosus*. Menands. October.

Diplodia Liriodendri *n. sp.*

Perithecia hemispherical, subdepressed, erumpent, single or two to four in a cluster, black; spores oval or oblong, at first simple, then uniseptate, colored, .0007 to .0009 in. long, .0005 broad.

Dead branches of tuliptree, *Liriodendron tulipifera*. Sandlake. June.

Diplodia multicaipa *n. sp.*

Perithecia very numerous, sometimes surrounding the branch on all sides, minute, erumpent, slightly prominent, partly covered by the longitudinally or stellately ruptured epidermis, black; spores oblong elliptical, .0007 to .0009 in. long, .0004 to .00045 broad.

Dead branches of sassafras. Carrollton. September.

Hendersonia epileuca *B. & C.*

Dead branches of red mulberry, *Morus rubra*. Saugerties. May.

Septoria Pteridis *n. sp.*

Perithecia hypophyllous, subconic, black; spores filiform, very long, curved or flexuous, continuous, .0003 to .0004 in. long.

Dead fronds of common brake, *Pteris aquilina*. Sandlake. June.

Melanconium zonatum *E. & E. in ed.*

Dead branches of ironwood, *Ostrya Virginica*. Clarksville. September.

This species has sometimes been referred to *M. bicolor*, which it resembles, but from which it may be distinguished by the absence of the conspicuous white stroma of that species and by the translucent zone in the middle of the spores.

Septomyxa Carpini *n. sp.*

(Plate 4, figs. 13 and 14.)

Heaps subcutaneous, slightly prominent, erumpent, whitish within; spores hyaline, narrowly fusiform, binucleate, at length uniseptate, oozing out and forming a subrufescent convex mass on the surface of the matrix.

Bark of water beech, *Carpinus Americana*. Meadowdale, Albany county. June.

Pestalozzia lignicola *Cke.*

Decorticated wood of spruce, *Picea nigra*. Redfield. July. It sometimes has a hysteriiform appearance.

Puccinia Spergulæ DC.

Living stems and leaves of corn spurry, *Spargula arvensis*. Redfield. July.

Doassansia Sagittariæ Fisch.

Living leaves of arrowhead, *Sagittaria variabilis*. Redfield. July. *Uredo Sagittariæ* West., *Protomyces Sagittariæ* Fekl. and *P. Bizzozzerianus* are given as synonyms.

Aspergillus aviarius n. sp.

(Plate 4, figs. 9 to 12.)

Sterile hyphæ creeping, white or whitish, fertile hyphæ erect, simple, continuous; .0003 in. thick, terminating at the apex in a globose vesicle, which is .0008 to .0012 in. broad, with an uneven or somewhat papillose surface; chains of spores growing directly from the surface of the vesicle, spores minute, globose, smooth, .00008 to .0001 in. broad, both these and the hyphæ at first whitish, then pale bluish-green or glaucous.

On the inner costal surface of a canary bird. New York. November. *E. B. Southwick*.

The bird from which this fungus was taken appeared to be sick for about four days immediately preceding its death. It would try to sing, but could not from hoarseness. It appeared to be cold, and was given a warm bath, but it died the following night. Upon cutting open the body the fungus was found. Its occurrence within the body of the bird is remarkable, and if it was the cause of its death it must be considered an injurious species. No other cause was evident. But how it could gain an entrance into the visceral cavity of the body and why it should fruit therein are mysteries.

The species differs from *A. virens* Lk. by its more slender hyphæ, smaller spores, papillose vesicle and by the grayish-blue or glaucous color of the patches.

Sporotrichum Lecanii n. sp.

Hyphæ very slender, .00008 to .0001 in. thick, procumbent, irregularly branched, branches suberect, white; spores minute, colorless-oblong or cylindrical, .0002 to .0003 in. long, .0001 to .00012 broad.

On scale insect of cucumber tree, *Magnolia acuminata*. Salamanca. September.

The fungus covers the insect with a dense white pulverulent coat. "The insect appears to be an undescribed species of *Lecanium*," *J. A. Lintner*.

Diplosporium breve *n. sp.*

Hyphæ caespitose, short, sparingly branched, white: spores oblong, uniseptate, slightly constricted at the septum, colorless, .0005 to .0006 in. long, .0002 to .00025 broad.

On some effete Sphæria. Redfield. July.

Didymaria Ungerii *Cd.*

Living leaves of northern buttercup, *Ranunculus septentrionalis*. Redfield. July.

Ramularia destruens *n. sp.*

(Plate 4, figs. 4 to 6.)

Tufts amphigenous, minute, gregarious, white, the hyphæ extremely short, .0002 to .0004 in. long: spores elliptical or oblong, colorless, .0002 to .0005 in. long, .00012 to .00015 broad.

Living leaves of mountain ash. *Pyrus Americana*. Hewitt's pond, Adirondack mountains. July.

This is a very destructive fungus. It quickly discolors and kills the leaves. The discoloration in most cases appears to progress from the apex toward the base of the leaf, which soon assumes a brown and dead appearance as if burned by fire. The effect is somewhat similar to that produced in the foliage of the apple and pear by the "blight." Nearly all the leaves were killed on the tree from which our specimens were taken.

The fruiting part of the fungus breaks out here and there on the dead leaves, but it is not abundant. The mischief is apparently due to the rapidly spreading mycelium. The species is one of the most minute of the genus, and is easily overlooked, though the effect of its work in the leaves is painfully evident.

Ramularia Junci *n. sp.*

Spots transverse, brown: hyphæ extremely short, caespitose spores very slender, straight or curved, often slightly narrowed toward one end, .001 to .002 in. long.

Living leaves of *Juncus marginatus*. Selkirk. June.

Ramularia graminicola *n. sp.*

(Plate 4, figs. 1 to 3.)

Spots small, numerous, irregular or subelliptical, pallid, surrounded by a broad, indeterminate brownish border: hyphæ amphigenous, short, colorless, .0005 to .001 in. long: spores subcylindrical, or fusiform, sometimes pointed at each end, sometimes becoming spuriously uniseptate, colorless, .001 to .0014 in. long.

Living leaves of fowl meadow grass, *Poa serotina*. Wilmurt lake. July.

This and the two preceding species are perhaps referable to the genus *Cylindrosporium* on account of their simple spores and short hyphæ.

Ramularia Heraclei Sacc.

Living leaves of cow parsnip, *Heracleum lanatum*. Morehouseville. July.

Cercosporella Veratri n. sp.

(Plate 4, figs. 7 and 8.)

Spots suborbicular or elliptical, blackish, slightly frosted by the epiphyllous subfusiform, mostly triseptate colorless spores, which terminate at one end in a long slender tapering almost hair-like point; hyphæ very short, almost obsolete; spores .002 to .004 in. long, .00016 to .0002 broad in the widest part.

Languishing leaves of Indian poke, *Veratrum viride*. Morehouseville. July.

Bispora effusa n. sp.

(Plate 4, figs. 15 to 17.)

Effused in a black somewhat velvety stratum; hyphæ erect, simple, colored, forming chains of spores; spores oblong, uniseptate, slightly constricted at the septum, .0005 to .0006 in. long, .00016 to .0002 broad.

Decorticated wood of sugar maple, *Acer saccharinum*. Adirondack mountains.

Cladosporium entoxylinum Cd.

Decorticated wood of spruce, *Picea nigra*. Wilmurt lake. July.

Septonema episphæricum n. sp.

Tufts confluent, blackish-brown; hyphæ and chains of spores often densely fasciculate, .005 to .006 in. long; spores variable, oblong or cylindrical, one to three septate, .0005 to .0012 in. long, .0002 to .0003 broad, colored or subhyaline.

On effete *Diatrype stigma*. Morehouseville. July.

Apparently allied to *S. bisporoides*, from which it differs in its larger spores and in its densely fasciculate mode of growth.

Coniothecium effusum Cd.

Decaying chestnut wood. Conklingville. September.

Epicoccum vulgare Cd.

Living or languishing leaves of arrowhead, *Sagittaria variabilis*. Carrollton. September. Our specimens belong to var. *pallescens* Rabenh.

Epicoccum diversisporum Preuss.

Decorticated wood of spruce. Wilmurt lake. July. Notwithstanding the great diversity between the habitat of our fungus and of the typical form of the species to which we have referred it, the agreement with the description is so close that we dare not separate our plant. The spores in it vary from .0003 to .0008 in. in diameter. Rarely it is not seated on a red spot. It grows in company with *Cladosporium entoxylinum*.

Valsa microstoma Fr.

Branches of wild red cherry, *Prunus Pennsylvanica*. Hewitt's pond, Adirondack mountains. July.

Valsa cooperta Cke.

Dead branches of elm, *Ulmus Americana*. Sandlake. June.

Eutypella cerviculata Sacc.

Dead trunks and branches of water beech, *Carpinus Americana*. Lyndonville. Fairman. Carrollton and Bethlehem. September.

Diaporthe binoculara Sacc.

Dead branches of cucumber tree, *Magnolia acuminata*. Carrollton. September.

Our specimens differ from the description of *D. binoculara* in the black circumscribing line which sometimes penetrates the wood slightly. The spores also are a little smaller than the dimensions given for those of that species, but in other respects the agreement is so well sustained that our plant is probably not specifically distinct. The spores in it are .0006 to .0007 in. long, about .0003 broad. It is sometimes associated with *Sphaeronema Magnolice*. The typical form was found on *Magnolia glauca*. It is *Valsa binoculara* Ellis.

Diaporthe tuberculosa Sacc.

Dead trunk of June berry, *Amelanchier Canadensis*. Carrollton. September.

Var. *dispersa*. Perithecia .02 to .025 in. broad, a little larger than in the type, the ostiola often piercing the epidermis separately.

Diaporthe rostellata Nitsch.

Stems of blackberry, *Rubus villosus*. Menands. July. Also on dead stems of *Rubus odoratus*. Salamanca.

This may be considered a noxious fungus. The plant found on blackberry stems had surrounded the stem with a pallid spot and had killed all the plant above this spot. The asci are often only four-spored.

Diaporthe Americana Speg.

Dead branches of cucumber tree. Carrollton. September.

The published description of this species is incomplete the spores in the specimens from which it was made being immature. In our specimens they are narrowly fusiform, acute at each end, quadrinucleate, .0006 to .0007 in. long, .00016 broad.

Massaria epileuca B. & C.

Dead branches of red mulberry, *Morus rubra*. Saugerties. May.

Caryospora minor n. sp.

(Plate 4, figs. 18 to 21.)

Perithecia .014 to .021 in. broad, slightly sunk in the matrix, subglobose, even, black; asci four to eight-spored, subcylindrical, .006 in. long, .0008 broad; spores fusiform, pointed at each end, uniseptate, slightly colored, .0018 to .002 in. long, .0005 broad.

Pericarp of hickory nut. Albany.

This differs from *C. putaminum* in its smaller perithecia which are not concentrically grooved and in its shorter, narrower and paler spores which are more numerous in an ascus.

Metasphaeria nuda n. sp.

Perithecia superficial, ovate or conical, submembranous, scattered or few collected together, black, the walls parenchymatous and blue under the microscope; asci about .003 in. long, .0005 broad; spores crowded or biseriate, fusiform, triseptate, colorless, .0007 to .0008 in. long, .00024 broad.

Dead stems of millet, *Panicum miliaceum*. Menands. October.

The species approaches *M. Panicorum*, from which it is distinct by its superficial perithecia and shorter spores. The superficial character of the perithecia would remove the species to *Zignoella*, but the texture is not carbonaceous, and it has therefore been placed in *Metasphaeria*.

Pleospora Asparagi *Reb.*

Dead stems of asparagus, *Asparagus officinalis*. Menands. April.
This species appears scarcely to differ from *P. herbarum* except in the fewer septa of the spores.

Lophiostoma vagans *Fab.*

Dead stems of *Lonicera tartarica*. Lyndonville. July. *Fairman*.

Stictis minuscula *Karst.*

Dead twigs of spruce, *Picea nigra*. Redfield. July.

Pseudopeziza Pyri *n. sp.*

Cups scattered, minute, .014 to .021 in. broad, hypophyllous, erumpent, surrounded by the laciniately ruptured epidermis, brownish when moist, blackish when dry, the margin incurved; hymenium whitish or grayish-white; asci subcylindrical, .002 to .0024 in. long; spores biseriate, oblong, straight or slightly curved, colorless, .0004 to .0005 in. long.

Fallen leaves of mountain ash, *Pyrus sambucifolia*. Cascadeville, Essex county. June.

Saccharomyces Betulæ *Pk. & Pat.*

(Plate 2, figs. 16 and 17.)

Conidia variable, elliptical, oblong or subcylindrical, often forming submoniliform strings of cells .0003 to .0008 in. long, .00016 broad, intermingled with slender mycelial threads, the whole forming a thin whitish gelatinous stratum.

Sap moistened cut surface of a birch stump, *Betula lutea*. New Baltimore, Greene county. May.

This is a curious species, apparently related to *S. albicans*, but differing from it in habitat and spore dimensions, and it is also peculiar and aberrant in having distinct hyphæ.

(D)

REMARKS AND OBSERVATIONS

Thalictrum purpurascens *L. var. ceriferum* *Aust.*

Fishkill mountains. June.

Cimicifuga racemosa *Nutt.*

Common in the Highlands and in the southwestern part of the State. It is rare in the eastern and northern parts.

***Nymphæa odorata* Ait.**

After flowering the peduncle sometimes takes the form of a spiral coil and thus shortens itself either to adapt itself to diminishing depth of water or to draw the ovary beneath the surface to mature its fruit.

Nalisneria spiralis does the same thing. Fruiting specimens showing the coiling of the peduncles were collected in Boreas pond, Adirondack mountains.

***Corydalis flavula* DC.**

Green pond, one mile east of Jamesville. Prof. L. M. Underwood.

***Lychnis vespertina* Sibth.**

Storm King station. June.

***Stellaria media* Smith.**

This chickweed is a very variable plant. It often lives through the winter and is then ready to bear fruit early in the spring. Specimens were collected in April last bearing an abundance of flowers and mature fruit. The plants were procumbent, the nodes short, leaves small and but slightly petioled, and the whole aspect was quite unlike that of the more erect large-leaved form that occurs later in the season. The fields where these plants grew were in cultivation the preceding summer, but the seeds apparently germinated after cultivation ceased, and the mild winter enabled the plants to perfect themselves and bear fruit early in the spring.

***Linum Virginianum* L.**

Selkirk. July. It is not rare to find two to four plants growing from the same root, and the old stem of last year's growth standing among them, thus indicating a perennial character.

***Rubus hispidus* L. var. *suberecta* n. var.**

Stems erect or recurved, densely beset with stiff bristles or weak prickles; leaves generally five-foliolate on the young plants, trifoliolate on old ones, the leaflets *thin*, broadest in the middle, rather sharply serrate, mostly *acute* or *short acuminate*, entire and wedge-shaped at the base.

Pastures and bushy places. Morehouseville. July.

This plant is so unlike the ordinary form of *R. hispidus* that I am constrained to consider it as a variety. It is quite abundant in the locality mentioned, growing chiefly in dry places. The young

shoots are perfectly erect and nearly always have the leaves either completely five foliated or the lateral leaflets deeply two-lobed, so that were it possible to overlook the dense coat of bristles with which the stem and petioles are clothed they might easily be mistaken for a small growth of *Rubus villosus*. The old stems usually become recurved as in *R. occidentalis*, and have the leaves of the flowering branches trifoliate. The peduncles and pedicels are mostly bristly and the sepals mucronate pointed. The plants grow from one to two feet high. Were the species of *Rubus* disposed to hybridize as some claim for *R. occidentalis* and *R. strigosus*, it might be asserted that this is a hybrid between *R. villosus* var. *frondosus* and *R. hispidus*, the former giving character to the leaves and the mode of growth, the latter to the clothing of the stem. The former was present in the vicinity of these plants, but the latter was not seen in that neighborhood. It is in my opinion to be considered a variety rather than a hybrid. The Caroga plant noticed in the Thirty-eighth report is the same thing. It approaches variety *setosus* T. & G. in some respects, but its thin leaves and more erect habit distinguish it.

***Myriophyllum tenellum* Bigel.**

Plentiful at the outlet of Cheney pond. August.

***Lythrum alatum* Pursh.**

Apparently well established in a pasture near Selkirk.

***Opuntia vulgaris* Mill.**

In grassy ground on the summit of a high hill in Columbia county, four miles south of Hudson, is a station for this plant. The hill is locally known as Mount Merino, and the plants are scattered over an area several rods in extent. The plants mostly exhibit the characters that would place them under *O. Rafinesquii*, but in some the short leaves of *O. vulgaris* are present. I therefore leave the species for the present under the name applied to it by Dr. Torrey in the State Flora.

***Galium triflorum* Mx.**

Professor R. P. Thomas informs me that this common plant, popularly known as "sweet-scented bed straw," has recently acquired considerable celebrity among some of the inhabitants of Montgomery county, because of its medicinal qualities. It is reported that an aggravated case of dropsy, which had been pronounced by the physicians hopeless and incurable, was cured by the

use of a decoction of this herb. In the United States Dispensatory, by Wood and Bache, *Galium Aparine* is noticed as having been used for dropsy, but I find no mention of this plant.

***Aster undulatus* L.**

A strongly marked form occurs near Carrollton, in which the leaves are mostly lanceolate with the margins very much curled or crisped.

***Aster Novi-Belgii* L.**

Boreas River, Adirondack mountains. August.

***Antennaria plantaginifolia* Hook.**

A peculiar form was collected in Sandlake, Rensselaer county. The flower heads are three to five, mostly four, racemosely placed at distances of a half inch or more. The stem is very slender, about a foot high, and the leaves are narrow, scarcely exceeding half an inch in the widest part.

***Rudbeckia triloba* L.**

This cone flower occurs in several places along the road between Rhinebeck and Rock City in Dutchess county. As in Ulster county, it appears to have escaped from cultivation in flower gardens. But few of the plants have the leaves three-lobed.

***Verbascum Lychnitis* L.**

Sandy soil at Sylvan Beach, Oneida county. A form with white flowers.

***Calopogon pulchellus* R. Br**

On the marsh near Kasoag a form was found having beautiful lilac-tinted flowers. Plants having flowers of the ordinary color grew near them and made the contrast more noticeable.

***Clintonia umbellata* Torr.**

This plant occurs as far east as Carrollton, Cattaraugus county. Some plants have the berries blue as in *C. borealis*, others have them black.

***Eleocharis intermedia* Schultes.**

Cheney pond. August. A small form with culms two to five inches long and spikes one to two lines.

***Scirpus Smithii* Gray.**

Sylvan Beach. July.

Carex folliculata L.

An unusual form of this sedge grows on "Beaver meadow" near Morehouseville. The stems are stout, erect, only one to two feet high, very leafy; the pistillate spikes are three to four, approximate, all on short erect peduncles.

Carex crinita Lam.

A large form with three staminate spikes all fertile at the apex was collected at Wilmurt lake, Hamilton county. Variety *minor* Boott was collected at Sylvan Beach, Oneida county.

Polypodium vulgare L. var. cristatum Lowe.

(Plate 1, figs. 1 to 4.)

Rock City, Dutchess county. October.

Fronds of this very beautiful and rare variety were sent me by Mr. Charles A. Coons. I afterwards visited the locality and found the fern growing in a small patch, probably six or eight feet long by one to two feet wide. All the fronds in this patch exhibited the peculiar character of those first sent me. Fronds of the usual form were growing near by but did not mingle with these, nor were any intermediate forms seen. The fronds are beautifully crested, being one to three times dichotomously or somewhat irregularly divided at the apex, and each segment is dilated at its apex and projects in two to six lobes, these lobes manifesting a disposition to extend themselves along the upper margin of the segment. Sometimes the branches at the apex are a little twisted or distorted and form a sort of rosette. The ultimate ones terminate in lobes similar to those at the apices of the segments. The fronds are fertile.

This variety was originally discovered in Ireland by Mr. Henry S. Perry. It was figured and described by Lowe in his work on New and Rare Ferns. This figure exhibits well the dilation and lobing of the apices of the segments in our plant, but shows the crested branching apex of the frond very poorly, for it is represented as scarcely more than bifurcate. His description reads thus: "Like *Aspidium filix-mas* var. *cristatum*, the present plant has multifid or tasseled apices on each pinna, the midrib of the frond dividing and branching about an inch below the apex of the frond, as well as the midrib of each pinna about a quarter of an inch below the apex of each pinna."

"The present variety, from the points of each frond being branched and crested and all the divisions terminating in crested tufts so as to form a frilled margin, is both distinct and beautiful."

In our plant there is apparently a tendency to branch and divide more freely at the apex of the frond and less freely and deeply at the apices of the segments than in the European. So far as I know it has not before been found in this country. Probably there will be a considerable demand for it by lovers and propagators of ferns, but it is to be hoped that specimens will not be taken so freely from the patch as to destroy the station.

Isoetes echinospora Durieu.

Cheney pond. August.

Riccia fluitans L. var. *Sullivantii* Aust.

Muddy places in ditches. Selkirk. June.

Collybia Familia Pk.

This species is not rare in Cattaraugus county. It grows in clusters of very many individuals on old prostrate trunks and decaying wood of hemlock. It varies in color from nearly white to brown. It is somewhat hygrophanous and the stem is more or less villose-tomentose at the base. It is allied to *C. acervata*, but the pileus is not umbonate, there are no rufous or incarnate tints either in the pileus lamellæ or stem, and the spores are minute and globose .00012 to .00016 inch in diameter, not elliptical as in that species.

Pleurotus atrocæruleus Fr.

In Sylloge the spores of this species are said to be globose, 2 to 3 mk. in diameter. If this is correct then the plant referred to this species in Report 39, p. 65, must be distinct. On the other hand both Smith and Cooke represent the spores of this species as elliptical and closely agreeing with those of the American plant in dimensions.

On the supposition that the English mycologists are correct in their representations of the spores of this species our plant can scarcely be more than a variety differing in color from the type. Fine specimens were found at Carrollton growing on the trunk of a cucumber tree. It seems best at least to designate it as a variety, for it does not appear to exhibit at all the dark blue hue so characteristic of the type.

Var. griseus. Pileus grayish or grayish-brown, clothed with rather coarse pointed whitish or grayish hairs; lamellæ not broad; spores elliptical, sometimes slightly curved, .0003 in. long, .00016 broad.

The pileus is sometimes attached by the vertex, and the margin is often beautifully crenately lobed or scalloped.

Entoloma cyaneum *Pk.*

Decaying logs in woods. Morehouseville. July. These specimens differ from the type in having the pileus grayish-brown and the stem wholly bluish. The species approaches *E. griseo-cyaneum* very closely, but differs in the color of the pileus. It is very rare.

Pholiota discolor *Pk.*

Two forms of this species are found. One has a scattered mode of growth, the other a caespitose. The latter was found on decaying wood of birch, *Betula lutea*, at Morehouseville. The species is allied to *P. marginata*, from which it is readily distinguished by its viscid pileus.

Stropharia squamosa *Fr.*

Specimens collected near Salamanca agree very closely with the description of this species, but they differ in having the pileus of a beautiful orange-red color. In this respect, and indeed in many other respects, they agree better with the description of *Stropharia thrausta*, but disagree in having the pileus neither hygrophanous nor glabrous. The plants are generally rather slender, though individuals occur having a stout stem and a pileus three or four inches broad. This is viscid and beautifully adorned with whitish superficial scales which are easily destroyed. The margin is often appendiculate. The lamellæ are broad and subdistant, and the stem is long, hollow, floccose-squamose and annulate. The whole plant is fragile, but this may be due in a measure to the fact that it is apt to be infested by the larvæ of insects. It is probably to be considered a variety of *S. squamosa* and is apparently equivalent to *Agaricus thraustus* var. *aurantiacus* of Cooke's Illustrations.

Boletus punctipes *Pk.*

Under pine trees. Corning, Stenben county. September. This species had not been observed by me since its discovery in 1878. The spores when first dropped are olive green on white paper, but the greenish hue soon fades or rather changes to brownish-ochraceous.

Coniophora puteana *Fr.*

If this species is rightly understood by me it is, as Fries says, a very variable one. It varies not only in the color of the hymenium but also in its character and in that of the margin. The hymenium

is sometimes even, sometimes tuberculose and occasionally rimose when dry, as in some species of *Corticium*. The margin may be broad naked and white or it may be obliterated by the hymenium. The subiculum is either thin and papery or thick and firm. It is sometimes separable from the matrix. It occurs on spruce, hemlock, birch, sycamore, ironwood, etc. A form is found on spruce having the characters of variety *areolata* Fr. except in the color of the hymenium.

Var. *tuberculosa* has the subiculum thick, firm, yellowish, the hymenium persistently tuberculose. This was found on sycamore, *Platanus occidentalis*.

Var. *rimosa*. Hymenium rimose. On hemlock, *Tsuga Canadensis*.

Doassantia Alismatis Cornu.

Living or languishing leaves of *Alisma Plantago*. Whitehall. September.

Fusicladium destruens Pk.

When my last report was written this fungus was suspected of being the cause of a disease in the oat plant. Observations made in the diseased oat fields the past summer lead to a different conclusion. The disease has appeared over a wide extent of country, and in the fields examined scarcely an unaffected plant could be found. Besides, other fungi, such as *Cladosporium herbarum* and *Dinemasporium graminum*, were found upon the dead and dying leaves. It may be affirmed that the presence of these fungi on the leaves is a consequence not a cause of their death, for these species are known to inhabit the dead tissues of plants. It is hardly probable that the *Fusicladium* could have spread so extensively, in so short a time, nor that it should be so omnipresent in every oatfield. It is more reasonable to suppose that it, like the other fungi mentioned, is a consequence rather than a cause of the disease. Many discolored leaves had no fungus upon them. An examination of the roots of the affected plants gave no indication of the presence of insects or nematoids.

Tuberculina persicina Sacc.

On blackberry rust, *Ceoma nitens*. Morehouseville.

Vibrissea truncorum Fr.

Var. *albipes*. Stem short, thick, white. Decaying wood about the margin of lakes. Hewitt's pond and Clear lake, Adirondack mountains. July.

The following species and varieties are extra limital. Having been sent to me for identification, and finding no description applicable to them, I place them on record here.

Tricholoma maculatescens *n. sp.*

Pileus compact, spongy, reddish-brown, convex then explanate, obtuse, even, slightly viscid when wet, becoming rivulose and brown-spotted in drying, flesh whitish, margin inflexed, exceeding the lamellæ; lamellæ slightly emarginate, rather narrow, cinereous; stem spongy fleshy, equal, sometimes abruptly narrowed at the base, solid, stout, fibrillose, pallid or whitish; spores oblong or subfusiform, pointed at the ends, uninucleate, .0003 in. long, .00016 broad.

Pileus 1.5 to 3 in. broad; stem 2 to 3 in. long, 6 to 9 lines thick.

Among fallen leaves in deciduous woods. Ohio. October and November. *A. P. Morgan.*

This appears to be related to *T. transmutans* and *T. flavobrunneum*, but may be distinguished from them by the spotting of the pileus and the shape of the spores.

Agaricus campestris *L.*

Var. *griseus*. Pileus pale-gray, silky, shining; annulus evanescent. Winchester, Virginia. October. *T. Taylor.*

This mushroom, though quite different in appearance from the ordinary forms of *A. campestris*, is scarcely more than a variety. Its spores are of the same size and character as in that species. It is eaten freely by the inhabitants of Winchester.

Armillaria mellea *Vahl.*

Var. *radicata*. Stem penetrating the ground deeply with a tapering, root-like prolongation.

London, Canada. *J. Dearness.*

The root-like prolongation of the stem is suggestive of that seen in *Collybia radicata*, but in all other respects the plant is *A. mellea*.

(E)

NEW YORK SPECIES OF TRICHOLOMA

Tricholoma *Fr.*

Hymenophorum continuous with the stem, the veil obsolete or only floccose or fibrillose and adherent to the margin of the pileus; lamellæ sinuate behind, not equally attenuate, adnate or decurrent; stem fleshy; not corticated.

The species of *Tricholoma* are numerous and are mostly rather large, having a fleshy pileus and a stout fleshy or fibrous-fleshy stem and white spores. The veil is usually very slight, consisting of a mere pruinosity or of a minute tomentum or of downy flocci or fibrils adhering to the margin of the pileus, and it is not often noticeable except in the young plant. The pileus is often thick and umbonate but very rarely umbilicate. The genus is distinguished from *Armillaria*, on one hand, by the entire absence of an annulus and from *Clitocybe*, on the other, by the sinuate or emarginate lamellæ and the fleshy or fibrous fleshy stem. From *Collybia*, in which the character of the lamellæ is similar, it is distinguished by its more fleshy pileus and stem and by its more terrestrial habitat, for nearly all its species grow on the ground.

Some of the species are known to be edible and probably many others are. None are known to be absolutely poisonous.

The species were arranged by Fries in two series, one of which was composed of four tribes, the other of three. One tribe in each series is yet unrepresented in our Flora. The principal distinguishing features of the series and tribes are found in the pileus.

KEY TO THE TRIBES

- | | |
|---|---------------------|
| Pileus viscid when moist..... | <i>Limacina</i> . |
| Pileus not viscid when moist | 1 |
| 1. Pileus dry | 2 |
| 1. Pileus not dry..... | 3 |
| 2. Pileus fibrillose or adorned with floccose or fibrillose scales..... | <i>Genuina</i> . |
| 2. Pileus punctate-granulose or adorned with smooth scales..... | <i>Rigida</i> . |
| 2. Pileus at first slightly silky, soon glabrous..... | <i>Sericella</i> . |
| 3. Pileus fleshy, soft, fragile, adorned with watery spots or rivulose..... | <i>Guttata</i> . |
| 3. Pileus compact, then spongy, glabrous, moist..... | <i>Spongiosa</i> . |
| 3. Pileus thin, hygrophanous..... | <i>Hygrophana</i> . |

SERIES A

Pileus viscid when moist, squamose, fibrillose, granulated or silky, or if glabrous, its flesh firm, not spongy, watery or hygrophanous; veil fibrillose.

Limacina

Pileus viscid when moist, either innately fibrillose, or squamulose, truly and firmly fleshy, not hygrophanous, the margin almost naked.

The species of this tribe are distinguished from those of all the other tribes by their viscid pileus. They are divided into two groups, in one of which the lamellæ are unchangeable in color or do not become reddish or reddish-spotted; in the other they change color with age or become reddish-spotted.

- Pileus white resplendens.
- Pileus not white 1
- 1. Lamellæ yellow equestre.
- 1. Lamellæ not yellow 2
- 2. Lamellæ not becoming reddish or reddish-spotted 3
- 2. Lamellæ becoming reddish or reddish-spotted 5
- 3. Lamellæ crowded, pileus glabrous 4
- 3. Lamellæ subdistant, pileus innately fibrillose sejunctum.
- 4. Pileus greenish-yellow intermedium.
- 4. Pileus pale alutaceous terriferum.
- 5. Pileus red or incarnate Russula.
- 5. Pileus tawny-red or reddish-brown 6
- 6. Pileus squamulose Peckii
- 6. Pileus not squamulose transmutans.

Lamellæ not becoming discolored nor red-spotted.

Tricholoma equestre L.

EQUESTRIAN TRICHOLOMA

(Hym. Europ. p. 48. Syl. Fung. Vol. V, p. 87.)

Pileus fleshy, compact, convex becoming expanded, obtuse, pale yellowish, more or less reddish tinged, the disk and central scales often darker, the margin naked, often flexuous, flesh white or tinged with yellow; lamellæ rounded behind, close, nearly free, *sulphur-yellow*; stem stout, solid, pale-yellow or white, white within; spores .00025 to .0003 in. long, .00016 to .0002 broad.

Pileus 3 to 5 in. broad; stem 1 to 2 in. long, 6 to 10 lines thick.

Pine woods, especially in sandy soil. Albany county. September to November.

This is a noble species but not plentiful in our State. The pileus is said to become greenish very late in the season. The stem, in the typical form, is described as sulphur-yellow in color, but with us it is more often white. The scales of the disk are sometimes wanting. In our plant the taste is slightly farinaceous at first, but it is soon unpleasant.

Variety *pinastreti* A. & S. is a slender form having a thin even pileus, thinner and more narrow lamellæ and a more slender stem. *Agaricus crassus* Scop., *A. aureus* Schæff. and *A. flavovirens* Pers. are recorded as synonyms of this species.

Tricholoma intermedium *Pk.*

INTERMEDIATE TRICHOLOMA

(N. Y. State Mus. Report 41, p. 60.)

Pileus thin, campanulate, obtuse, glabrous, slightly viscid when moist, greenish-yellow, flesh white; lamellæ crowded, free or slightly adnexed, white; stem equal, firm, glabrous, white; spores broadly elliptical, .0002 in. long, .00016 broad.

Pileus 2 to 3 in. broad; stem 1 to 2 in. long, 3 to 5 lines thick.

Thin woods. Catskill mountains. September.

This species resembles some forms of *T. equestre*, from which it is separated by its white lamellæ. It appears to be intermediate between that species and *T. sejunctum*, from which its glabrous pileus and crowded lamellæ distinguish it.

Tricholoma sejunctum *Sow.*

SEPARATING TRICHOLOMA

(Hym. Europ. p. 48. Syl. Fung. Vol. V, p. 88.)

Pileus fleshy, convex then expanded, umbonate, slightly viscid, streaked with innate brown or blackish fibrils, whitish or yellowish, sometimes greenish-yellow, flesh white, fragile; lamellæ broad, subdistant, rounded behind or emarginate, white; stem solid, stout, often irregular, white; spores subglobose, .00025 in. broad.

Pileus 1 to 3 in. broad; stem 1 to 3 in. long, 4 to 8 lines thick.

Mixed woods. Suffolk county. September.

The plants referred to this species are not uncommon on Long Island, growing in sandy soil in woods of oak and pine. They are usually more or less irregular and the pileus becomes fragile. It is quite variable in color, sometimes approaching a smoky-brown hue, again being nearly white. The taste of the typical form is said to be bitter, but the flavor of our plant is scarcely bitter. In other respects, however, it agrees well with the description of the species.

Tricholoma terriferum *Pk.*

EARTH-BEARING TRICHOLOMA

(N. Y. State Mus. Rep. 41, p. 60.)

Pileus broadly convex or nearly plane, irregular, often wavy on the margin, glabrous, viscid, pale-alutaceous, generally soiled with adhering particles of earth carried up in its growth, flesh white,

with no decided odor; lamellæ thin, *crowded*, slightly adnexed, white, not spotted or changeable; stem equal, short, solid, white, *floccose-squamulose at the apex*; spores minute, subglobose, .00012 in. long.

Pileus 3 to 4 in. broad; stem 1 to 1.5 in. long, 6 to 8 lines thick.

Woods. Catskill mountains. September.

Tricholoma resplendens Fr.

RESPLENDENT TRICHOLOMA

(Hym. Europ., p. 49, Syl. Fung., Vol. V, p. 90.)

Pileus fleshy, convex then nearly plane, even, glabrous, *viscid*, *white*, sometimes hyaline-spotted or yellowish on the disk, shining when dry, the *margin straight*, flesh white, taste mild, odor pleasant; lamellæ nearly free when young, then emarginate, somewhat crowded, rather thick, entire, white; stem *solid*, glabrous, subbulbous, even, dry, white; spores .0003 in. long, .00016 broad.

Pileus 2 to 4 in. broad; stem 2 to 3 in. long, 4 to 8 lines thick.

Thin woods. Catskill mountains. September.

This species, which is rare with us, is distinguished from all our remaining white species by its viscid pileus.

Lamellæ becoming discolored or red-spotted.

Tricholoma Russula Schæff.

REDDISH TRICHOLOMA

(Hym. Europ. p. 52. Syl. Fung., Vol. V, p. 94. *Agaricus rubicundus*. Report 26, p. 51.)

Pileus fleshy, convex, becoming plane or centrally depressed, obtuse, viscid, even or dotted with granular squamules on the disk, *red or incarnate*, the margin usually paler, involute and minutely downy in the young plant, flesh white, sometimes tinged with red, taste mild; lamellæ subdistant, rounded behind or subdecurrent, white, often becoming red-spotted with age; stem solid, firm, whitish or rose-red, squamulose at the apex; spores elliptical, .00028 in. long, .00016 broad.

Pileus 3 to 5 in. broad; stem 1 to 2 in. long, 6 to 8 lines thick.

Mixed woods. Albany, Cattaraugus and Steuben counties. September and October.

According to the description the typical plant has the pileus incarnate and the stem rosy-red, but in the American plant the pileus is generally more clearly red and the stem white, though this is often varied with reddish stains. These discrepancies in our plant led to its publication as a distinct species, but in Mycological Illus-

trations, fig. 926, *T. Russula* is represented with a bright red pileus, and it has seemed best to refer our plant to that species. The disk in it is often squamulose-dotted, rather than granulated. The species is recorded edible, but I have not tested it.

Tricholoma transmutans *Pk.*

CHANGING TRICHOLOMA

(N. Y. State Mus. Rep. 29, p. 38.)

Pileus convex, *nearly glabrous*, viscid when moist, brownish, reddish-brown or tawny-red, usually paler on the margin, flesh white, taste and odor farinaceous; lamellæ narrow, close, sometimes branched, whitish or pale-yellowish, becoming dingy or reddish-spotted when old; stem equal or slightly tapering upward, *glabrous* or slightly silky-fibrillose, stuffed or hollow, whitish, often marked with reddish stains or becoming reddish-brown toward the base, white within; spores subglobose, .0002 in. broad.

Pileus 2 to 4 in. broad; stem 3 to 4 in. long, 3 to 6 lines thick.

Woods. Albany, Rensselaer and Essex counties. August to September.

The plants are often cæspitose. The species is related to a group of closely allied forms including *T. fulvellum*, *T. albobrunneum*, *T. ustale* and *T. pessundatum*, from all of which it is distinguished by its farinaceous odor. It is also related to *T. flavobrunneum* and *T. frumentaceum*, which have a similar odor, but from which it differs in its subglobose, smaller spores. I suspect that *Agaricus frumentaceus* of Curtis' catalogue belongs to this species. Both the pileus and stem, as well as the lamellæ, are apt to assume darker hues with age or in drying, and this character suggested the specific name. The species is classed as edible.

Tricholoma Peckii *Howe.*

PECK'S TRICHOLOMA

(Bull. Torrey Bot. Club, vol. vi, p. 66.)

Pileus convex or nearly plane, viscid when moist, *squamulose*, tawny-red inclining to tawny-orange, flesh white, odor farinaceous; lamellæ narrow, close, sometimes branched, white; stem equal or slightly thickened at the base, *squamulose*, white at the top, elsewhere colored like the pileus; spores minute, broadly elliptical or subglobose, .00016 to .0002 in. long.

Pileus 2 to 3 in. broad; stem 2 to 3 in. long, 4 to 6 lines thick.

Thin woods. Rensselaer, Cattaraugus and Steuben counties and Catskill mountains. August and September.

This is a beautiful species, but it does not retain its colors well in drying. It is somewhat similar in appearance to the preceding species, but it is easily distinguished from all the related ones by its squamulose pileus and stem. As in the allied species, its lamellæ become discolored or spotted with age. It is perhaps edible, but I have not yet had an opportunity to test it, and the taste, though at first farinaceous and pleasant, is sometimes followed by a bitterish unpleasant flavor. In wet weather the margin of the pileus and upper part of the stem are sometimes studded with drops of moisture of a reddish or orange color.

Genuina

Pileus neither moist nor viscid, generally floccose-squamose or fibrillose, flesh soft, not hygrophanous, the margin at first involute and subtomentose.

The species of this tribe as well as those of the preceding one may be arranged in two groups depending on the character of the lamellæ. In one the color of the lamellæ is unchangeable in the other it changes with age. Some of the species have a slight farinaceous odor, at least when broken, others are inodorous. In most of them the pileus is adorned with squamules or fibrils.

- | | |
|--|----------------|
| Lamellæ neither changing color nor becoming spotted..... | 1 |
| Lamellæ changing color or becoming spotted | 6 |
| 1. Pileus white, taste not farinaceous | Columbetta. |
| 1. Pileus white, squamulose, taste farinaceous | grande. |
| 1. Pileus not pure white..... | 2 |
| 2. Lamellæ yellow | rutilans. |
| 2. Lamellæ not clearly yellow | 3 |
| 3. Lamellæ transversely striate..... | striatifolium. |
| 3. Lamellæ not transversely striate..... | 4 |
| 4. Pileus glabrous | flavescens. |
| 4. Pileus not glabrous..... | 5 |
| 5. Stem squamose, tawny or ochraceous | decorosum. |
| 5. Stem fibrillose, white | scalpturatum. |
| 6. Pileus with reddish brown or tan colored hues | 7 |
| 6. Pileus some other color..... | 9 |
| 7. Stem subbulbous, white | tricolor. |
| 7. Stem equal or nearly so, not white | 8 |
| 8. Stem solid | imbricatum. |
| 8. Stem hollow..... | vaccinum. |

9. Lamellæ whitish, becoming cinereous *terreum*.
 9. Lamellæ becoming blackish 10
 10. Lamellæ subdistant, pileus brown *fuligineum*.
 10. Lamellæ crowded, pileus whitish *fumescens*.

Lamellæ not changing color or becoming spotted.

Tricholoma decorosum *Pk.*

DECOROUS TRICHOLOMA

(N. Y. State Mus. Rep., 25, p. 73. Plate 1, figs. 1-4.)

Pileus firm, at first hemispherical, then convex or nearly plane, adorned with numerous *brownish subsquarrose tomentose scales*, dull ochraceous or tawny, flesh white; lamellæ close, rounded and slightly emarginate behind, the edge subcrenulate; stem solid, equal or slightly tapering upward, white and smooth at the top, elsewhere *tomentose-squamulose* and colored like the pileus; spores broadly elliptical, .0002 in. long, .00015 broad.

Pileus 1 to 2 in. broad; stem 2 to 4 in. long, 2 to 4 lines thick.

Decaying trunks of trees. Catskill mountains and Allegany county. September and October.

A rare but beautiful species. It is often caespitose. It departs from the character of the genus in growing on decayed wood. It bears some resemblance to *Clitocybe decora* Fr., from which it differs in color, in the character of the scales of the pileus and stem and in the color of the flesh and lamellæ. The true relationship of that species may be regarded as yet unsettled. Fries at one time placed it in *Pleurotus* at another in *Clitocybe*. Gillet has referred it to *Clitocybe*, Quelet to *Tricholoma*, and Saccardo to *Pleurotus*. But it seems to me that the American plant here described belongs to the genus *Tricholoma* notwithstanding its unusual habitat. The emarginate lamellæ and the solid fleshy stem indicate it.

Tricholoma rutilans *Schæff.*

REDDISH TRICHOLOMA

(Hym. Europ., p. 53. Syl. Fung., Vol. V, p. 96.)

Pileus fleshy, campanulate becoming plane, dry, at first *covered with a dark-red or purplish tomentum*, then somewhat squamulose, the margin thin, at first involute, flesh yellow; lamellæ crowded, rounded, *yellow, thickened and villose on the edge*; stem somewhat hollow, nearly equal or slightly thickened or bulbous at the base, soft, pale-yellow variegated with red or purplish floccose squamules; spores .00025 to .0003 in. long, .00025 broad.

Pileus 2 to 4 in. broad; stem 2 to 4 in. long, 5 to 8 lines thick.

On or about pine stumps, rarely on hemlock trunks. Rensselaer, Albany, Oneida, Lewis, Cattaraugus and Fulton counties. July to November.

The species is somewhat variable in size and color. When old the pileus sometimes becomes yellowish, variegated with purplish or reddish stains. The villosity on the edge of the lamellæ is not always equally developed. *T. variegatum* of the Twenty-third Report, page 74, is probably only a small form of this species having the edges of the lamellæ nearly naked.

Tricholoma sculpturatum Fr.

SCRATCHED TRICHOLOMA

(Hym. Europ., p. 55. Syl. Fung. Vol. V, p. 100. *Agaricus implitoides* N. Y. State Mus. Rep. 32, p. 25.)

Pileus at first conical or convex, then expanded, obtuse, dry, covered with tomentum which at length forms *brownish or reddish floccose scales, whitish*, flesh whitish; lamellæ somewhat crowded, emarginate, whitish, sometimes becoming yellowish when old; stem equal, solid or stuffed, fibrillose, white; spores elliptical, .00025-.0003 in. long; .00016 to .0002 broad.

Pileus 2 to 3 in. broad; stem 2 to 3 in. long, 3 to 6 lines thick.

Woods. Saratoga county. August.

Our plant has a farinaceous taste, about which nothing is said in the description of the European plant. In other respects the characters are well sustained by it.

Tricholoma flavescens Pk.

PALE-YELLOWISH TRICHOLOMA

(N. Y. State Mus. Rep. 26, p. 51.)

Pileus convex, firm, often irregular, dry, *slightly silky, becoming glabrous*, sometimes cracking into minute scales on the disk, *whitish or pale yellow*, flesh whitish or yellowish; lamellæ close, white or pale-yellow, emarginate, floccose on the edge; stems firm, solid, often unequal, central or sometimes eccentric, single or cæspitose, colored like the pileus; spores subglobose, .0002 in. in diameter.

Pileus 2 to 3 in. broad; stem 1 to 2.5 in. long, 4 to 6 lines thick.

Pine stumps. Albany and Rensselaer counties. October.

The species seems to be related to *T. rutilans* but has not the red or purplish tomentum of that fungus. It, like *T. decorosum*, is always lignicolous, *T. rutilans* is sometimes so.

Tricholoma Columbetta Fr.

DOVE-COLORED TRICHOLOMA

(Hym. Europ., p. 55. Syl. Fung., Vol. V, p. 99.)

Pileus convex, then nearly plane, fleshy, obtuse, rigid, somewhat flexuous, dry, at first *glabrous*, then *silky-fibrillose*, becoming even or squamulose, *white*, the margin at first *involute*, more or less tomentose, flesh white, taste *mild*; lamellæ close, emarginate, thin, white; stem stout, solid, unequal, nearly glabrous, white; spores, .00028 to .0003 in. long, .00016 to .0002 broad.

The species is very variable and the following varieties have been described.

Var. A. Pileus nearly always repand or lobed, at first glabrous, even, at length rimose-squamose, often reddish-spotted, the margin when young inflexed, tomentose; stem obese, even, unequal, swollen, an inch thick. The typical form.

Birch woods among mosses.

Var. B. Pileus subflexuous, silky-fibrillose, at length squamulose, sometimes fuscous-spotted, the margin scarcely tomentose; stem longer, equal or slightly narrowed at the base.

Bushy places. Intermediate between A. & C.

Var. C. Pileus regular, flattened, evidently fibrillose, sometimes spotted with blue, four inches broad; stem equal, cylindrical, fibrillose-striate, four inches long.

Beech woods. A showy variety so diverse from variety A that it might be regarded as a distinct species, did not variety B connect them and so much resemble both that it might with equal propriety be referred to either.

Pileus 2 to 4 in. broad; stem 1 to 4 in. long, 3 to 12 lines thick.

Woods and pastures. Albany county.

It may be distinguished from *T. album* by its mild taste. It is recorded as edible.

Tricholoma grande Pk.

GRAND TRICHOLOMA

(N. Y. State Mus. Rep., 44, p. 128.)

Pileus thick, firm, hemispherical, becoming convex, often irregular, dry, *squamulose*, somewhat silky-fibrillose toward the margin, *white*, the margin at first *involute*, flesh grayish-white, taste *farinaceous*; lamellæ close, rounded behind, adnexed, white; stem stout, solid, fibrillose, at first tapering upward, then equal or but slightly thickened at the base, pure white; spores elliptical, .00035 to .00045 in. long, .00024 broad.

Pileus 4 to 5 in. broad; stem 2 to 4 in. long, 1 to 1.5 in. thick.

Among fallen leaves in woods. Cattaraugus county. September.

The plants are often caespitose, and then the pileus is more or less irregular and the lamellæ somewhat lacerated. The species is related to *T. Columbetta*, from which its larger size, constantly squamulose pileus, more caespitose mode of growth, larger spores and farinaceous taste separate it. The squamules of the pileus are brownish, and the pileus itself is sometimes slightly dingy on the disk. The young margin is pure white like the stem, and both it and the upper part of the stem are sometimes studded with drops of moisture.

The plant was found on trial to be edible, but not of first quality. The flesh is not very tender, nor the flavor captivating even in young specimens.

Tricholoma striatifolium *Pk.*

STRIATE-LEAVED TRICHOLOMA

(N. Y. State Mus. Rep. 30, p. 37.)

Pileus convex or nearly plane, dry, subglabrous, somewhat shining, often obscurely dotted or squamulose with innate fibrils, grayish or grayish-brown, sometimes tinged with red, flesh white; lamellæ rather close, rounded behind, *transversely striated or venose*, white; stem slightly thickened at the base, *hollow*, white; spores subglobose or broadly elliptical, .00016 to .0002 in. long.

Pileus 2 to 3 in. broad; stem 1 to 2 in. long, 3 to 6 lines thick.

Woods. Saratoga county. October.

A rare species collected but once. The striate appearance of the lamellæ is due to the presence of small transverse vein-like elevations. The stem is of a pure chalky-white color. The odor is perceptible and peculiar.

Lamellæ changing color or becoming spotted.

Tricholoma tricolor *Pk.*

THREE-COLORED TRICHOLOMA

(N. Y. State Mus. Rep. 41, p. 60.)

Pileus broadly convex or nearly plane, sometimes slightly depressed in the center, firm, dry, obscurely striate on the margin *pale-olutaceous inclining to russet*, flesh whitish; lamellæ thin, narrow, close, adnexed, *pale-yellow, becoming brown or purplish-brown* in drying; stem stout, short, firm, tapering upward from the thickened or subbulbous base, *white*; spores broadly elliptical or subglobose, .0003 in. long.

Pileus 2 to 4 in. broad; stem 2 to 3 in. long, 6 to 12 lines thick.

Woods. Albany county. August.

The species is remarkable for its varied colors and for the peculiar hue assumed by the dried lamellæ.

Tricholoma imbricatum Fr.

IMBRICATED TRICHOLOMA

(Hym. Europ., p. 56. Syl. Fung., Vol. V, p. 101.)

Pileus fleshy, *compact*, convex or nearly plane, obtuse, dry, innately squamulose, fibrillose toward the margin, brown or reddish brown, the margin thin, at first slightly *inflexed and pubescent*, then *naked*, flesh firm, thick, white; lamellæ slightly emarginate, almost adnate, rather close, white when young, becoming reddish or spotted; stem *solid*, firm, nearly equal, fibrillose, white and mealy or pulverulent at the top, elsewhere colored like the pileus; spores .00025 in. long, .00016 to .0002 broad.

Pileus 2 to 4 in. broad; stem 2 to 3 in. long, 4 to 10 lines thick.

Under or near coniferous trees. Greene and Essex counties. September and October.

This is an edible species. It has a farinaceous odor and taste when fresh.

Tricholoma vaccinum Pers.

VACCINE TRICHOLOMA

(Hym. Europ., p. 56, Syl. Fung., Vol. V., p. 102.)

Pileus fleshy, convex or campanulate, becoming nearly plane, umbonate, dry, floccose-squamose, reddish-brown, the margin *involute, tomentose*, flesh white; lamellæ adnexed, subdistant, whitish, then reddish or reddish-spotted; stem equal, *hollow*, covered with a fibrillose bark, naked at the apex, whitish-rufescent; spores subglobose, .00024 in. long.

Pileus 1 to 3 in. broad; stem 2 to 3 in. long, 4 to 6 lines thick.

Under or near coniferous trees. Greene and Essex counties. September and October.

This species resembles the preceding one from which it may be distinguished by the tomentose margin of the pileus and the stuffed or hollow stem. In the American plant the pileus is sometimes streaked with innate fibrils and sometimes becomes longitudinally rimose. It is not always umbonate. It has a farinaceous taste.

Both it and the preceding species are somewhat gregarious and occur in the same localities. They are especially found in groves or thickets of young spruce trees.

Tricholoma terreum Schæff.

EARTH-COLORED TRICHOLOMA

(Hym. Europ., p. 57. Syl. Fung., Vol. V, p. 104.)

Pileus fleshy, thin, soft, convex campanulate or nearly plane, obtuse or umbonate, *innately fibrillose* or *floccose-squamose*, cinereous fuscous grayish-brown or mouse-color, flesh white or whitish; lamellæ adnexed, subdistant, more or less eroded on the edge, *white becoming cinereous*; stem equal, varying from solid to stuffed or hollow, fibrillose, white or whitish; spores broadly elliptical, .00024 to .00028 in. long, .00016 to .0002 broad.

Pileus 1 to 3 in. broad; stem 1 to 2 in. long, 2 to 4 lines thick.

Woods. Albany, Rensselaer and Cattaraugus counties. September to November.

Var. *fragrans* n. var. Pileus innately fibrillose, obtuse, odor farinaceous. Dutchess county.

This is a very variable species and European authors do not fully agree upon the characters that belong to it. According to Fries it is subinodorous, but Stevenson says it is inodorous. One author describes the spores as "nearly spherical," .0002 in. long, another says they are .00024 to .00028 in. long, .00016 broad. The spores of our plant agree closely with the latter measurement. The plants are sometimes gregarious, sometimes cæspitose. The larger forms often have the pileus obtuse fibrillose or squamulose and less regular, the smaller ones more regular, more floccose-squamulose and often with a very small umbo or papilla. I find this form especially in pine woods. It varies considerably in color and is a pretty little plant. The variety *fragrans* is generally a little larger and is edible, though it retains somewhat of the farinaceous flavor. This appears to be common farther south, and I suspect that *Agaricus hypopythius* of Curtis' Catalogue is the same thing.

T. argyraceum Bull., in which the lamellæ and commonly the pileus also are pure white is considered by Fries as a subspecies of *T. terreum*. *T. argyreum* Kalchb. he thinks is the same as Bulliard's plant. *T. atosquamosum* Chev., in which the whitish or cinereous umbonate pileus is adorned with minute black scales, and *T. orirubens* Quel., in which the lamellæ have a rosy-red edge, are also made subspecies of *T. terreum* by Stevenson.

Tricholoma fumescens *Pk.*

SMOKY TRICHOLOMA

(N. Y. State Mus. Rep. 31, p. 32.)

Pileus convex or expanded, dry, clothed with a very minute appressed tomentum, whitish; lamellæ narrow, crowded, rounded behind, whitish or pale cream color, *changing to smoky-blue or blackish* where bruised; stem short, cylindrical, whitish; spores oblong-elliptical, .0002 to .00025 in. long.

Pileus 1 in. broad; stem 1 to 1.5 in. high, 2 to 3 lines thick.

Woods. Columbia county. October. Rare.

The species is remarkable for the smoky or blackish hue assumed by the lamellæ when bruised and also in drying. It is apparently related to *T. immundum* Berk., but in that species the whole plant becomes blackish when bruised, and the lamellæ are marked with transverse lines and tinged with pink.

Tricholoma fuligineum *Pk.*

SOOTY TRICHOLOMA

(N. Y. State Mus. Rep. 41, p. 60.)

Pileus convex or nearly plane, obtuse, often irregular, dry, minutely squamulose, *sooty-brown*, flesh grayish, odor and taste farinaceous; lamellæ subdistant, uneven on the edge, cinereous *becoming blackish in drying*; stem short, *solid*, equal, glabrous, cinereous; spores oblong-elliptical, .0003 in. long, .00016 broad.

Pileus 1 to 2.5 in. broad; stem 1 to 1.5 in. long, 3 to 5 lines thick.

Among mosses in open places. Greene county. September. Rare.

Rigida

Pileus rigid, in compact species hard and somewhat cartilaginous, in thinner species very fragile, the margin naked, the pellicle of the pileus rigid, punctate granulate, or broken up when dry into small smooth scales, neither viscid, floccose-scaly nor torn into fibrils.

No representative.

Sericella

Pileus at first slightly silky, soon becoming glabrous, very dry neither moist, viscid, hygrophanous nor distinctly scaly, rather thin, opaque, absorbing moisture, but the flesh of the same color as the lamellæ; stem fleshy, fibrous.

T. fallax and *T. infantile* are somewhat moist in wet weather, but are placed in this group because of their manifest nearness to species belonging to it. The same is true of *T. albiflavidum*.

- Pileus white or whitish, often darker on the disk or umbo.... 1
 Pileus some other color..... 5
1. Pileus acutely umbonate subacutum.
 1. Pileus not acutely umbonate..... 2
 2. Lamellæ subdistant 3
 2. Lamellæ crowded 4
 3. Plant inodorous, pileus wholly white..... silvaticum.
 3. Plant with a strong odor, pileus darker on the disk.. terreolens.
 4. Stem slightly bulbous albidiflavum.
 4. Stem not at all bulbous lascivum.
 5. Stem solid 6
 5. Stem hollow..... 7
 6. Lamellæ white, pileus pale tan color lascivum.
 6. Lamellæ and pileus yellowish... chrysenteroides.
 7. Lamellæ yellow. fallax.
 7. Lamellæ whitish infantile.

Tricholoma subacutum *Pk.*

SUBACUTE TRICHOLOMA

(N. Y. State Mus. Rep. 42, p. 16.)

Pileus at first ovate or broadly conical, then convex and *subacutely umbonate*, dry, silky and obscurely virgate with *minute innate fibrils*, *whitish*, tinged with smoky-brown or bluish-gray, darker on the umbo, flesh white, taste acrid or peppery; lamellæ rather close, slightly adnexed, white; stem equal, *stuffed or hollow*, silky-fibrillose, white; spores broadly elliptical or subglobose, .00025 to .0003 in. long, .0002 to .00025 broad.

Pileus 1.5 to 3 in. broad; stem 2 to 4 in. long, 3 to 6 lines thick.

Woods and groves. Essex county. September.

This species is perhaps too closely related to *T. virgatum*, but it is separable by its prominent subacute umbo, paler pileus, hollow stem and hot or peppery taste. The cuticle is separable from the pileus.

Tricholoma silvaticum *Pk.*

WOOD TRICHOLOMA

(N. Y. State Mus. Rep. 42, p. 17.)

Pileus convex or nearly plane, dry, *glabrous*, *subumbonate*, whitish; lamellæ broad, ventricose, subdistant, adnexed, white; stem subequal, *solid*, white; spores *rather large*, elliptical, .00045 to .0005 in. long, .0003 broad.

Pileus 1 to 1.5 in. broad; stem 1 to 2 in. long, 2 to 4 lines thick.

Mossy ground in woods. Essex county. September.

The whole plant is white or whitish, as in *T. leucocephalum*, from which it is separated by its subdistant lamellæ, somewhat umbo-nate pileus and by the absence of any farinaceous odor.

Tricholoma terræolens *Pk.*

EARTH-SMELLING TRICHOLOMA

(N. Y. State Mus. Rep. 38, p. 84.)

Pileus thin, convex or nearly plane, slightly silky-fibrillose, whitish with a brownish or grayish-brown slightly prominent disk, *taste and odor strong, unpleasant*; lamellæ subdistant, emarginate, white; stem equal, slightly silky, shining, *stuffed or hollow*, white; spores subglobose or broadly elliptical, .00025 to .0003 in. long, .0002 to .00025 broad.

Pileus 10 to 15 lines broad; stem 1 to 1.5 in. long, about 2 lines thick.

Under ground hemlock, *Taxus Canadensis*. Saratoga county. September.

The species is related to *T. inamœnum*, from which it is separated by its smaller size, less distant lamellæ, stuffed or hollow stem and different odor. Nor is the stem radicating or the disk tinged with yellow as in that species. The odor is decidedly earthy, resembling that of vegetable mold or mossy rocks. Its taste is similar to its odor and remains in the mouth and throat a long time.

Tricholoma lascivum *Fr.*

DISGUSTING TRICHOLOMA

(Hym. Europ., p. 65, Syl. Fung., Vol. V., p. 112.)

Pileus fleshy, convex or nearly plane, obtuse, at length somewhat depressed, silky, then glabrous, even, whitish or pale tan color, the margin at first involute, flesh white; lamellæ adnexed, thin, *crowded, white*; stem solid, equal, rigid, *rooting and tomentose at the base*, fibrillose, white; spores .0003 to .0004 in. long, .00014 broad.

Pileus 1 to 2 in. broad; stem 2 in. long, 2 to 4 lines thick.

Open places. Albany county. September.

The European plant has the pileus pallid-tan color and has a strong odor. In our plant there was no marked odor and the pileus was nearly white.

Tricholoma albiflavum *Pk.*

YELLOWISH-WHITE TRICHOLOMA

(N. Y. State Cabinet Rep., 23, p. 75.)

Pileus fleshy, convex, becoming plane or slightly depressed, glabrous, even, *white sometimes tinged with yellow*, the margin at first involute, flesh white; lamellæ narrow, crowded, thin, emarginate,

white; stem equal, solid, fibrillose-striate, *somewhat bulbous*, whitish; spores elliptical, .0003 to .00035 in. long, .00016 to .0002 broad.

Pileus 2 to 3 in. broad; stem 3 to 4 in. long, 3 to 4 lines thick.

Woods and fields. Essex and Rensselaer counties. August.

This species is very closely allied to the preceding one of which it is perhaps only a variety. It is separable by the pileus which varies in color from white to yellowish and by the stem which is slightly bulbous thickened at the base but not radicated. The stem is generally very slender in proportion to the size of the pileus. This is sometimes slightly and broadly umbonate. In very wet weather the pileus is moist but the species has been placed here because of its affinity with *T. lascivum*.

Tricholoma chrysenteroides *Pk.*

GOLDEN-FLESH TRICHOLOMA

(N. Y. State Mus. Rep. 24, p. 60.)

Pileus fleshy, convex or plane, not at all umbonate, firm, dry, glabrous or slightly silky, *pale-yellow or buff*, becoming dingy with age, the margin sometimes reflexed, *flesh pale-yellow*, *taste and odor farinaceous*; lamellæ rather close, emarginate, yellowish, becoming dingy or pallid with age, *marked with transverse veinlets along the upper edge*, the interspaces venose; stem equal, firm, *solid*, glabrous, fibrous-striate, yellowish without and within; spores elliptical, .0003 to .0004 in. long, .0002 to .00024 broad.

Pileus 1 to 2 in. broad; stem 2 to 3 in. long, 3 to 4 lines thick.

Woods. Lewis and Cattaraugus counties. September.

Nearly allied to *T. chrysenterum*, but separable by the lamellæ, which are somewhat veiny and not free, by the entire absence of an umbo and by its farinaceous odor and taste.

Tricholoma fallax *Pk.*

FALLACIOUS TRICHOLOMA

(N. Y. State Mus. Rep. 25, p. 74. Plate 1, figs 5 to 8.)

Pileus firm, convex or nearly plane, rarely centrally depressed, moist in wet weather, glabrous, dull saffron, subochraceous or reddish yellow, *flesh yellowish* when dry; lamellæ narrow, close, tapering outwardly, rounded behind, *yellow*; stem short, glabrous, slightly tomentose at the base, equal or tapering downward, *stuffed or hollow*, colored like the pileus; spores minute, elliptical, .00012 to .00016 in. long.

Pileus 6 to 15 lines broad; stem about 1 in. long, 1 to 2 lines thick.

Under spruce and balsam trees. Essex, Lewis, Herkimer and Onondaga counties. August and September.

This pretty little agaric is liable to be mistaken for a species of *Naucoria*, because of its peculiar colors, but its spores are white. It is apparently closely related to *T. cerinum*, but the pileus of that species is described as very dry, the flesh white and the stem glabrous at the base, characters which are not well shown by our plant. Because of its affinity to *T. cerinum* it has been placed in the tribe *Sericella* notwithstanding its pileus is moist in wet weather.

Tricholoma infantile *Pk.*

INFANTILE TRICHOLOMA

(Bulletin N. Y. State Mus., Vol. 1, Number 2.)

Pileus thin, convex or nearly plane, even, minutely silky, *moist in wet weather, reddish-gray*, the margin at first incurved and whitish: lamellæ subdistant, plane or slightly ventricose, often eroded on the edge, whitish; stem short, equal or tapering upward, hollow, slightly silky, colored like the pileus or a little paler; spores broadly elliptical, .0003 to .00035 in. long, .0002 to .00025 broad, often containing a shining nucleus.

Pileus 4 to 12 lines broad; stem 1 to 1.5 in. long, 1 to 2 lines thick.

Gravelly soil in fields. Rensselaer county. June.

This small species is apparently related to *P. cœlatum*, from which it is separated by its pileus which is not at all umbilicate, but on the other hand is sometimes papillate. The stem is fleshy-fibrous and hollow but its cavity is very small. In the larger specimens the margin of the pileus is often wavy or irregular and the edge of the lamellæ eroded. This and the preceding species by being somewhat moist in wet weather form a transition to the next Series.

SERIES B

Pileus glabrous, either watery-spotted, moist or hygrophanous, not viscid, its flesh very thin or becoming soft or spongy; veil pruinose.

Guttata

Pileus fleshy, soft, fragile, spotted as if by drops or rivulose; stem solid. Mostly vernal, growing in troops or cæspitose.

No representative.

Spongiosa

Pileus compact, becoming spongy, fleshy quite to the margin, obtuse, even, glabrous, moist; stem stout, fibrous-spongy, commonly thickened at the base; lamellæ at length spuriously but sinuately decurrent.

Mostly autumnal, growing in troops. *T. album*, *T. nobile* and *T. laterarium*, though having the pileus dry, are placed in this group because of their affinities and their agreement with it in other respects.

- * Lamellæ reticulately connected patulum.
- Lamellæ distinct 1
- 1. Pileus wholly white or white tinged with yellow rust color . . . 2
- 1. Pileus some other color 6
- 2. Stem hollow leucocephalum.
- 2. Stem solid 3
- 3. Margin of the pileus with subdistant short radiating ridges laterarium.
- 3. Margin of the pileus even 4
- 4. Lamellæ changing color with age grave.
- 4. Lamellæ not changing color 5
- 5. Pileus glabrous album.
- 5. Pileus minutely squamulose nobile.
- 6. Lamellæ at first violaceous personatum.
- 6. Lamellæ at first white or whitish 7
- 7. Lamellæ becoming tawny or subochraceous grave.
- 7. Lamellæ not assuming this color 8
- 8. Pileus greenish virescens.
- 8. Pileus smoky-yellow fumosiluteum.
- * 8. Pileus whitish tinged with brown fumidellum.

Tricholoma patulum Fr.

WIDE TRICHOLOMA

(Hym. Europ. p. 69. Syl. Fung., Vol. v, p. 125. *Clitocybe patuloides*. N. Y. State Mus. Rep., 32, p. 25.)

Pileus fleshy, firm, convex or plane, obtuse, often repand, even, glabrous, pale cinereous inclining to yellowish, flesh white; lamellæ emarginate, crowded, *reticulately connected*, white; stem thick, solid, firm, equal, elastic, glabrous, white or whitish; spores subglobose or broadly elliptical, .00025 to .0003 in. long.

Pileus 1 to 4 in. broad; stem 2 to 3 in. long, 4 to 10 lines thick.

Thin woods and groves. Onondaga county. September.

The American plant differs slightly from the description of the European, in having the lamellæ somewhat decurrent, and on this account it was formerly referred to the genus *Clitocybe* and described as distinct. The spore characters here given are taken from the American plant.

Tricholoma album Schæff.

WHITE TRICHOLOMA

(Hym. Europ., p. 70. Syl. Fung., Vol. v, p. 127.)

Pileus fleshy, tough, convex, becoming plane or depressed, obtuse, very dry, even, *glabrous, white*, sometimes yellowish on the disk, rarely wholly yellowish, the margin at first involute, flesh white, taste *acid or bitter*; lamellæ emarginate, somewhat crowded, distinct, white; stem solid, elastic, equal or tapering upward, externally fibrous, obsoletely pruinose at the apex, white; spores elliptical, .0002 to .00025 in. long.

Pileus 2 to 4 in. broad; stem 2 to 4 in. long, 4 to 6 lines thick.

Woods. Common. Albany, Essex, Herkimer, Cattaraugus and Greene counties. August to October.

This species is variable in color and in size, being sometimes robust, sometimes slender. It grows singly, in troops or in tufts. It has no decided odor but a bitter unpleasant taste. It departs from the character of the tribe in having the pileus quite dry and on this account, as Fries remarks, it might perhaps be better placed in the tribe *Sericella*. The same remark is applicable to the two following species. The variety *cesariatus* differs from the typical form in having the pileus thin, and at first silky, the lamellæ almost free and the slender fragile stem somewhat pruinose at the apex. *T. alboides*, Report 32, p. 25, apparently belongs to this variety.

Tricholoma nobile Pk.

NOBLE TRICHOLOMA

(N. Y. State Mus. Rep. 42, p. 17.)

Pileus fleshy, convex or nearly plane, dry, *minutely punctate or squamulose with innate fibrils*, whitish or tinged with yellow, flesh white, taste unpleasant; lamellæ broad, rather close, *rounded behind and slightly adnexed*, white, slowly changing to pale-yellow where wounded; stem equal, solid, slightly floccose-pruinose, whitish; spores minute, subglobose, .00016 to .0002 in. broad.

Pileus 2 to 4 in. broad; stem 1.5 to 2.5 in. long, 4 to 8 lines thick.

Woods. Essex county. September.

This plant might easily be mistaken for *T. album*, so close is the resemblance between them, and yet it is quite distinct by its minute though rather obscure squamules, the insertion of the lamellæ and the subglobose spores. Its taste is very unpleasant and leaves a burning sensation in the mouth and throat for a long time.

Tricholoma laterarium *Pk.*

SIDE-MARKED TRICHOLOMA

(N. Y. State Mus. Rep., 26, p. 51.)

Pileus convex or nearly plane, sometimes slightly depressed in the center, pruinose, whitish, the *disk often tinged with brick-red or brown*, the thin margin marked with slight, subdistant, short radiating ridges, flesh white; lamellæ narrow, crowded, emarginate, decurrent in slight lines, white; stem nearly equal, solid, white; spores globose, .00018 in. broad.

Pileus 2 to 4 in. broad; stem 2 to 3 in. long, 3 to 5 lines thick.

Woods. Otsego and Oneida counties. June and July.

It resembles some forms of *T. album*, but is separable by the markings on the margin of the pileus and by its globose spores.

Tricholoma leucocephalum, *Fr.*

WHITE-CAP TRICHOLOMA

(Hym. Europ., p. 71. Syl. Fung., Vol. v. p. 123.)

Pileus fleshy, thin, tough, convex or plane, obtuse or obtusely umbonate, even, moist, at first *minutely silky, then glabrous, white*, the margin spreading, naked, flesh white, odor farinaceous; lamellæ thin, crowded, rounded behind, free, white; stem *hollow, glabrous, rooting* at the narrowed solid base, subcartilaginous, white.

Pileus 1 to 2.5 in. broad; stem 1 to 2 in. long; 2 to 4 lines thick.

Pine groves. Green county. September.

European authors do not agree in the dimensions ascribed to the spores of this species. In Sylloge Fungorum they are said to be .00036 to .0004 in. long, .00028 to .00032 broad, and according to Lanzi they are .0002 to .00024 in. long, .00016 broad. In our plant they are of the latter dimensions.

Tricholoma fumidellum, *Pk.*

LITTLE-SMOKY TRICHOLOMA

(N. Y. State Mus. Rep. 26, p. 52.)

Pileus convex, then expanded, subumbonate, glabrous, moist, *dingy-white or clay-color clouded with brown*, the disk or umbo generally smoky-brown; lamellæ crowded, subventricose, whitish;

stem equal, glabrous, *solid*, whitish; spores minute, subglobose, .00018 in. long, .00015 broad.

Pileus 1 to 2 in. broad; stem 1.5 to 2.5 in. long, 2 to 3 lines thick.

Woods. Albany county and Catskill Mountains. September and October.

The stem splits easily and the pileus becomes paler in drying. It sometimes becomes rimose-areolate.

Tricholoma virescens *Pk.*

GREENISH TRICHOLOMA

(N. Y. State Mus. Rep. 25, p. 74. *Agaricus viriditinctus*, Rep. 33, p. 36. *Tricholoma viriditinctum*, Syl. Fung., Vol. V., p. 123.)

Pileus convex or nearly plane, sometimes centrally depressed, moist, glabrous, *dingy-green*, the margin sometimes wavy or lobed; lamellæ close, gradually narrowed toward the outer extremity, rounded or slightly emarginate at the inner, white; stem subequal, *stuffed or hollow*, thick but brittle, whitish, sometimes tinged with green; spores broadly elliptical, .0002 in. long, .00015 broad.

Pileus 3 to 5 in. broad; stem 3 to 4 in. long, 6 to 12 lines thick.

Thin woods. Essex county. July.

The dull smoky-green hue of the pileus is the distinguishing feature of this species. The elevation of the Friesian subgenera to generic rank enables me to restore the original name of this species, for *Agaricus virescens* B. and C., which antedated it, now becomes *Leptonia virescens*.

Tricholoma fumosiluteum *Pk.*

SMOKY-YELLOW TRICHOLOMA

(N. Y. State Mus. Rep. 27, p. 92.)

Pileus fleshy, convex or nearly plane, moist, glabrous, *smoky-yellow*, flesh white, tinged with yellow under the cuticle, taste farinaceous; lamellæ broad, close, rounded behind and deeply emarginate, white; stem stout, glabrous, hollow, white, spores subglobose, .00018 to .00024 in. in diameter.

Pileus 2 to 3 in. broad; stem 3 to 4 in. long, 4 to 6 lines thick.

Woods. Sullivan, Cattaraugus, Ulster and Greene counties. September.

The flesh, when cut, emits a farinaceous odor. The plant sometimes grows in tufts. In size and general character it is related to *T. virescens* so closely that it might easily be regarded as a mere yellowish variety of it. The disk of the pileus is often darker than the margin, and the pileus is sometimes spotted.

Tricholoma personatum Fr.

MASKED TRICHOLOMA

(Hym. Europ. p. 72. Syl. Fung., Vol. V. p. 130.)

Pileus compact, becoming soft, thick, convex or plane, obtuse, regular, moist, glabrous, variable in color, generally pallid or cinereous tinged with violet or lilac, the margin at first *involute and villose-pruinose*, flesh whitish; lamellæ broad, crowded, rounded behind, free, *violaceous becoming sordid-whitish or fuscous*; stem generally thick, subbulbous, solid, fibrillose or villose-pruinose, whitish or colored like the pileus; spores *sordid-white*, subelliptical, .0003 to .00035 in. long, .00016 to .0002 broad.

Pileus 2 to 5 in. broad; stem 1 to 3 in. long, 6 to 12 lines thick.

Woods and open places. Common. Albany, Rensselaer, Greene, Delaware, Cattaraugus and Madison counties. September and October.

This species is quite variable in color, but easily recognized after it is known. The pileus is rarely whitish or cinereous, but usually it exhibits dull violaceous or dingy lilac or fuscous hues and the lamellæ are somewhat similar in color. The lamellæ are separable from the hymenophore and the species has for this reason sometimes been placed in the genus *Lepista*. A form occurs in which the stem is decidedly bulbous, and there is also a small form scarcely attaining the dimensions given above. It grows either singly or in troops, rarely in tufts. It is an edible species with tender and well-flavored flesh.

Tricholoma grave Pk.

HEAVY TRICHOLOMA

(N. Y. State Mus. Rep. 43, p. 17.)

Pileus at first hemispherical, then convex, compact, glabrous, *grayish-tawny* and somewhat spotted when moist, paler when dry, the margin paler, irregular, involute, covered with a minute close grayish-white tomentum or silkiness, flesh grayish-white; lamellæ sub-distant, rounded behind or sinuate, adnexed, at first *whitish*, then *pale-ochraceous or tawny*; stem stout, compact, solid, subsquamulose, grayish-white, penetrating the soil deeply; spores broadly elliptical, .0003 in long, .0002 broad.

Pileus 5 to 8 in. broad; stem 4 in. long, 1 to 1.5 in. thick.

Mixed woods. Suffolk county. September.

This species is remarkable for its great size and weight. It is apparently allied in this respect to *T. Colossus*, from which it is separated by the absence of any viscosity of the pileus, by the

radicating character of the base of the stem and by the flesh not assuming a reddish color. Its moist pileus places it among the Spongiosi rather than the Limacini among which *T. Colossus* is placed.

Hygrophana

Pileus thin, subumbonate, hygrophanous, the flesh at first compact, then soft, very thin toward the margin, moist or watery.

- | | |
|--|----------------|
| Stem solid or stuffed | 1 |
| Stem hollow | 4 |
| 1. Lamellæ whitish, often tinged with brown or violaceous..... | 2 |
| 1. Lamellæ white or yellowish | 3 |
| 2. Stem less than one inch long | brevipes. |
| 2. Stem one inch or more in length | sordidum. |
| 3. Stem white | Trentonense. |
| 3. Stem not white | microcephalum. |
| 4. Pileus some shade of red | 5 |
| 4. Pileus grayish or brownish | 6 |
| 5. Lamellæ whitish..... | Sienna. |
| 5. Lamellæ alutaceous..... | thujinum. |
| 6. Lamellæ cinereous | putidum. |
| 6. Lamellæ yellowish | Hebeloma. |

Tricholoma brevipes Bull.

SHORT-STEMMED TRICHOLOMA

(Hym. Europ., p. 75. Syl. Fung., Vol. V, p. 135.)

Pileus fleshy, convex becoming plane, rigid, then soft, glabrous, umber or isabelline, becoming pale with age; lamellæ close, ventricose, emarginate, fuscous becoming whitish; stem *very short, solid*, firm, rigid, somewhat thickened at the base, *fuscous*; spores elliptical, .0003 in. long, .0002 broad.

Pileus 1 to 2 in. broad; stem 6 to 9 lines long, 2 to 3 lines thick.

Fields and gardens. Albany county. October.

Tricholoma sordidum Fr.

SORDID TRICHOLOMA

(Hym. Europ., p. 77. Syl. Fung., Vol. V, p. 139.)

Pileus thin, campanulate or convex, then plane or centrally depressed, sometimes with a small umbo, often irregular or eccentric, glabrous, hygrophanous, brown with a reddish or violaceous tint and striatulate on the margin when moist, sordid or subcinereous when dry, flesh white; lamellæ thin, moderately close, rounded or sinuately and slightly decurrent, violaceous whitish or fuligin-

ous; stem equal or slightly thickened at the base, solid or stuffed, fibrillose-striate, colored like the pileus, white within; spores elliptical. .00024 to .0003 in. long, .00016 to .0002 broad.

Pileus 1 to 2 in. broad; stem 1.5 to 2 in. long, 2 to 3 lines thick.

Manured ground. Albany county. May.

It sometimes grows in a crowded subcaespitose manner. It has a peculiarly sordid appearance and a strange admixture of colors difficult to describe.

Tricholoma Trentonense *Pk.*

TRENTON TRICHOLOMA

(N. Y. State Mus. Rep. 24, p. 60.)

Pileus thin, convex or nearly plane, often irregular, glabrous or subvirgate, hygrophanous, slightly striatulate on the margin when moist, dingy-white, the disk generally brown; lamellæ very narrow, crowded, slightly emarginate, white inclining to yellowish; stem short, equal, *solid*, slightly striate, *white*; spores .0002 in. long, .00016 broad.

Pileus 1 to 2 in. broad; stem 1 to 1.5 in. long, 3 to 5 lines thick.

Woods on the ground or on decaying wood. Oneida county. September. The plant is gregarious or subcaespitose. It has not been found since its discovery in 1870.

Tricholoma microcephalum *Karst.*

SMALL-CAP TRICHOLOMA

(Syl. Fung., Vol. V, p. 135.)

Pileus fleshy, thin, sooty-livid, when dry isabelline-livid; lamellæ adnexed, very crowded, soft, white; stem tall, stuffed, equal, naked, striatulate, becoming pallid; spores subglobose .0002 to .00024 in. long, .0002 broad.

Pileus 9 to 14 lines broad; stem 2 to 3 in. long, 1 to 2 lines thick.

Meadows and pastures. Essex county. September.

Our specimens do not agree fully with the above description. In color they correspond very closely with the figures of *T. melaleucum* in Mycological Illustrations, but the spore characters agree better with those ascribed to *T. microcephalum*.

Tricholoma Sienna *Pk.*

YELLOWISH-RED TRICHOLOMA

(N. Y. State Rep. 24, p. 60.)

Pileus rather thin, convex then plane or slightly depressed, glabrous, hygrophanous, obscurely striatulate on the extreme margin when moist, *yellowish-red*; lamellæ moderately close, whitish; stem

equal, glabrous, *hollow, colored like the pileus*; spores elliptical, .00024 to .0003 in. long, .00016 to .0002 broad.

Pileus 1 to 2 in. broad; stem 2 to 3 in. long, 3 to 4 lines thick.

Woods. Lewis county. September.

Not found since its discovery in 1870.

Tricholoma thujinum *Pk.*

ARBOR-VITÆ TRICHOLOMA

(N. Y. State Mus. Rep. 26, p. 52.)

Pileus convex or centrally depressed, glabrous, hygrophanous, pale-alutaceous, the margin generally irregular wavy or lobed; lamellæ crowded, thin, abruptly emarginate, *alutaceous*; stem slightly thickened at the top, glabrous, hollow, colored like the pileus, whitish-villose at the base; spores minute, .00016 in. long, about half as broad.

Pileus 1 to 2 in. broad; stem 1 to 1.5 in. long, 2 to 3 lines thick.

Swampy ground under trees of arbor-vitæ, *Thuja occidentalis* Onondaga county. July.

Not found since its discovery in 1872.

Tricholoma putidum *Fr.*

STRONG-SMELLING TRICHOLOMA

(Hym. Europ., p. 78. Syl. Fung., Vol. V, p. 140.)

Pileus somewhat fleshy, hemispherical, umbonate, even, soft, hygrophanous, somewhat olivaceous-gray when moist, hoary when dry, occasionally sprinkled with a white silkiness, odor like that of rancid meal; lamellæ adnexed, appearing free, ventricose, crowded, *cinereous*; stem hollow, soft, fragile, fibrous, equal or subcompressed, pruinose, grayish: spores .0003 to .0004 in. long, .00016 broad.

Pileus about 1 in. broad; stem 1 to 2 in. long, 2 to 3 lines thick.

Pine groves. Greene county. September.

In the New York specimens the pileus is not umbonate, but in other respects they agree well with the description of the species.

Tricholoma Hebeloma *Pk.*

HEBELOMA-LIKE TRICHOLOMA

(N. Y. State Mus. Rep. 26, p. 53.)

Pileus thin, broadly conical or subcampanulate, obtuse, hygrophanous, brown with a darker disk and striatulate on the margin when moist, grayish when dry; lamellæ broad, rounded behind and

deeply emarginate, adnexed, *yellowish*; stem equal, hollow, glabrous, pallid; spores .00025 in. long, .00016 broad.

Pileus about 5 lines broad; stem 1 in. long, about 1 line thick.

Woods. Otsego county. July.

Agaricus hordus, Rep. 25, p. 73, and *Agaricus præfoliatus*, Rep. 32, p. 55, are both referable to *Collybia platyphylla*, Fr. as large fleshy-stemmed forms.

Agaricus multipunctus, Rep. 25, p. 73, is scarcely distinct from *Clitocybe decora* Fr. and is therefore omitted here.

Agaricus Schumacheri, Rep. 24, p. 60, proves to be a form of *Clitocybe nebularis* Batsch.

Agaricus limonium, Rep. 26, p. 52, is referable to *Collybia scorzonerea* Batsch.

Agaricus lacunosus, Rep. 26, p. 51, has a very tough substance and must be referred to *Collybia*.

Agaricus rubescentifolius, Rep. 39, p. 38, has also been shown by later observations to be a species of *Collybia* and now stands as *Collybia rubescentifolia*.

(F)

FUNGI OF MARYLAND

The fungi recorded in the following pages have been found in Maryland, and most of them have been illustrated and described in a large manuscript volume by Mary E. Banning of Baltimore, Maryland. This volume she has most generously donated to the New York State Museum, and it has been made the basis of the following enumeration. Nearly all the species represented in the volume belong to the larger fleshy fungi and are included among the Hymenomycetes and Gasteromycetes. Of these, 14 have been described as new species and these descriptions have been here transcribed for publication that they may thereby be made more accessible to students of mycology. Remarks have also been freely quoted from the volume when they seemed to have especial interest or scientific value. The name of each species is followed by the name of the locality where it was found, except in the case of very common ones, and by the number of the plate on which it is figured. In some instances different forms or varieties of one species are figured on different plates. The old subgenera of the former genus *Agaricus* are here raised to generic rank, according to the plan of *Sylloge Fungorum*.

<i>Amanita rubescens Pers.</i>	Druid Hill Park	Plate	1
" "	Eastern Maryland	Plate	2
" "	Halls Spring near Baltimore..	Plate	3

"Found in woods in every section of Maryland from July until September, but very variable in size as well as in depth of color. Plate 2 represents plants collected in Eastern Maryland in 1870, also in woods near Halls Spring, Baltimore county. Its spores are globose."

The plants represented on Plate 2 also have the stem beautifully and distinctly adorned below the annulus with red scales. These and the globose spores indicate that the plant is worthy of distinction as a variety if not as a species.

<i>Amanita muscaria L.</i>	Eastern Maryland	Plate	4
" "	.....	Plate	5
" "	.....	Plate	6
" "	.....	Plate	7

Plate 4 represents a large form with pileus yellow; plate 6 a small form with pileus brownish, thereby approaching variety *umbrina*; plate 7 represents a form wholly white.

"I have found the scarlet form in the primeval forests of the eastern shore of Maryland. The white form is not so common as those with a yellow pileus."

<i>Amanita solitaria Bull.</i>	Carroll county	Plate	8
<i>Amanita strobiliformis Vitt.</i>	Druid Hill Park	Plate	9

"I found this plant during the great drought of 1879. The earth was dry and hard, yet some of the plants had reached a very large size. * * * They grew near a spring, which may account for the perfection of the plants. * * * The odor from them was delightful, somewhat resembling that of our edible *A. campestris*, but more powerful. The aroma from the bulb is even greater than from the pileus."

<i>Amanita nitida, Fr.</i>	Halls Spring	Plate	10
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"Common in nearly every woods in Maryland."

<i>Amanita phalloides Fr.</i>	Common	Plate	11
<i>Amanita verna Bull.</i>	Druid Hill Park	Plate	12
<i>Amanita spissa Fr.</i>	Carroll county	Plate	174

"I have referred this plant to *A. spissa* because it so closely agrees with the description of that species as given in all the books. It must be the American form of that plant. * * * Spores white, globose or subglobose, .00024 inch. The spore measure does not agree with W. G. Smith's measurement which is .0005 in. long, pear shaped or balloon shaped, with a short stalk."

Amanita pellucidula *n. sp.* Baltimore..... Plate 15

"Pileus at first campanulate, then expanded, slightly viscid, fleshy in the center, attenuated at the margin, smooth, bright red, deeper at the top, shaded into clear transparent yellow at margin, glossy, flesh white, unchanging; lamellæ ventricose, free, numerous, yellow; ring descending, fugacious; stem stuffed. I have named this plant '*pellucidula*' because of its bright color. I could not get the spore measure. It has not appeared since July, 1877. I am now, August 20, 1888, under the impression that it is an aborted form or variety of *Amanita cæsarea* Scop. I have met with several like it, near or in company with more perfect larger forms. The stem is white in most cases, or very pale cream color, always ventricose. Spores the same as those of *A. cæsarea*."

The plant figured differs from the true *A. cæsarea* in its brilliantly colored pileus with even margin and in the white stem.

Amanita cæsarea Scop. Common..... Plate 16

" " Plate 17

" " Plate 18

"This plant varies greatly in color. Sometimes the pileus is bright scarlet with yellow margin, then burnt sienna color with yellowish margin. It varies also in size. It generally appears in July and continues until the last of August, and even into September. Its taste is not disagreeable. * * * There is not one doubt that this fungus can be eaten with impunity. The taste is mild and pleasant, it has no disagreeable odor, and it is plentiful."

Amanitopsis vaginata Bull. Druid Hill Park Plate 13

" " Plate 14

"For three successive years I found this fungus in Druid Hill Park in one spot, on or about the fifteenth of July. In 1878 it was missing there, but appeared plentiful in a distant wood. In 1880 it again made its appearance in Druid Hill Park, on the fifteenth of July, and under the same tree. There was not the slightest variation in the size or color of the plants that appeared under this tree during the first three years, neither in 1880."

Amanitopsis volvata Peck. Baltimore..... Plate 19*Lepiota Americana* Peck. Druid Hill Park Plate 20

" " Carroll county Plate 22

"This figure is from plants found in Carroll county, Maryland. They were plentiful in lawns and gardens, and much larger and more perfect than those found in Druid Hill Park. The pileus is not so red, the margin is plicate and the flesh turns red when cut or bruised, but it does not exude a red juice like the others."

The plants represented on Plate 20 approach very closely to *Lepiota Badhami* B. & Br. but are brighter colored than it.

<i>Lepiota procera</i> Scop. Druid Hill Park.....	Plate 21
<i>Lepiota cepæstipes</i> Sow. Carroll county.....	Plate 23
<i>Lepiota rubrotincta</i> Peck. Carroll county.....	Plate 24
“ “ Carroll county.....	Plate 25
<i>Lepiota cristata</i> A. & S. Carroll county.....	Plate 26
<i>Armillaria mellea</i> Vahl. Common.....	Plate 27
“ “	Plate 28
“ “	Plate 171
“ “	Plate 172

“Plate 28 represents a form with smooth pileus, the most common form in Maryland. It abounds at the roots of trees, on old stumps, in the corners of old fences, in fact everywhere where there is old wood. The taste is not so nauseous as some represent it, yet it reveals the fact that deception may lurk under a pleasant title, ‘the honey agaric.’ * * One taste led me to suspect it was a wolf in sheep’s clothing.”

<i>Tricholoma rancidulum</i> n. sp. Druid Hill Park ...	Plate 29
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“Pileus 6 to 8 inches across, dry, sometimes marked with rugose lines, glossy, white with a tinge of ochre at the disk, flesh white, brittle, margin striate, sometimes sinuate, then regular, odor very disagreeable; lamellæ slightly decurrent, at first nearly white, then dingy pinkish or brownish ochre, narrow, brittle, separated from the pileus by a touch, close, forked; stem white or dingy white, brownish at base, curved, stuffed, elastic, nearly equal, smooth; spores .00016 x .0002 inch, white.

“In woods. Gregarious. It grows chiefly in vegetable mold.”

<i>Tricholoma cellare</i> Banning Baltimore.....	Plate 30
<i>Tricholoma subdurum</i> n. sp. Druid Hill Park.....	Plate 31

“Pileus at first hemispherical, then expanded, white, turning dark in age, margin more or less waved, flesh hard, tough; lamellæ yellow, adnexed, close, forked; stem stout, 2.5 inches high, enlarged at base, attenuated upward, white, solid.

“In woods. October, 1875.”

<i>Tricholoma Brownei</i> Banning. Common.....	Plate 32
<i>Tricholoma magnum</i> n. sp. Baltimore.....	Plate 33

“Pileus at first hemispherical, then expanded, 6 inches broad, fleshy, smooth, silky, cream color, flesh white, firm; lamellæ adnate, emarginate, not crowded, at first white, turning pale salmon or cream color; stem at first solid, then hollow, short, tapering at the base.”

<i>Tricholoma nudum</i> Bull.	Baltimore	.....	Plate 34
<i>Tricholoma edurum</i> n. sp.	"	.....	Plate 35

"Pileus at first convex, obtuse, thick, fleshy, undulating, hygrophanous, in age expanded, with a slight central depression, margin at first involute, expanding unequally, sometimes lobed, at first dingy white or alutaceous, deepened in shade at the apex, epidermis thin, easily separable; lamellæ white or cream color, adnexed, not crowded except at the margin, easily separable from the flesh of the pileus; stem white, firm, thickened at base, tapering toward the top, sometimes nearly equal, at first solid, then stuffed; spores nearly globose, white, .00025 to .0003 in. broad.

"Pileus 4 to 5 in. across; stem 3 to 4 in. long.

"Taste mild, odor pleasant but powerful, resembling that of our edible mushroom, *A. campestris*. Gregarious."

<i>Tricholoma personatum</i> Fr.	Baltimore	.....	Plate 37
<i>Clitocybe illudens</i> Schw.	Anne Arundel county	.....	Plate 173
" "	Howard county	.....	Plate 38
<i>Clitocybe trullisata</i> Ellis.	Baltimore county	.....	Plate 39
" "	"	.....	Plate 40
<i>Clitocybe infundibuliformis</i> Schæff.	Druid Hill Park	...	Plate 41
<i>Clitocybe amethystina</i> Bolt.	Druid Hill Park	.....	Plate 42

"This is the amethystine variety of *Clitocybe laccata*. The spores are the same in size and color, though the pileus differs greatly in appearance."

<i>Clitocybe laccata</i> Scop.	Druid Hill Park	.....	Plate 43
" "	Halls Spring	.....	Plate 44
" "	"	.....	Plate 154

"Plate 154 shows this plant with a zoned pileus. Rev. J. Stevenson speaks truly when he calls it 'a most provoking agaric.' At first I thought I had in it a new species, but upon close examination I found that *C. laccata* had taken a freak to come out in a decidedly zoned dress. This is the third drawing in this book showing the variations in this plant."

<i>Clitocybe odora</i> Bull.	Baltimore	.....	Plate 45
<i>Clitocybe aquatica</i> n. sp.	Druid Hill Park	.....	Plate 46

"Pileus at first obtuse, then expanded, pale ochre, often flesh color, depressed in the center, sprinkled with floccose evanescent scales, margin waved and slightly striate; lamellæ narrow, decurrent, not crowded, forked, ochraceous; stem 6 to 7 inches long, densely cæspitose, stuffed, elastic, attenuated at base, enlarged at the apex and striate from the lengthened lamellæ, concolorous; spores .00018x.00032 in., white.

"I have found this plant in various sections of the State and always growing in wet places in woods or by streams; thus I name it *O. aquatica*."

<i>Collybia platyphylla</i> Fr. Baltimore	Plate 36
<i>Collybia radicata</i> Relh. Druid Hill Park	Plate 48
<i>Collybia siticulosa</i> n. sp. Baltimore	Plate 47

"Pileus fleshy in the center, thin at margin, at first decidedly umbonate, then depressed, margin at first involute, ochraceous; lamellæ free, not distant, dirty white or pale cream color; stem cartilaginous, hollow, twisted, flattened where it unites with the pileus, very pale ochre.

"This fungus is particularly tough and dry, so much so that it is unnecessary to submit it to the usual process for preservation. Hence its name *siticulosa*."

<i>Collybia subrigua</i> n. sp. Carroll county	Plate 49
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"Pileus convex, then expanded, sometimes broadly umbonate, then centrally depressed, dark brown at disk, ochraceous at the margin, hygrophonous, shining when dry, flesh white, margin thin, split; lamellæ white, narrow, adnate, forked, close, turning dirty white in age; stem stuffed with thready particles, nearly equal, blunt at base, flattened at the apex, twisted, striate where it meets the lamellæ, pallid; spores .00022x.00034 in. white.

"The plant was excessively hygrophonous when first collected, it then became dry and shining."

<i>Pleurotus mitis</i> Pers. Druid Hill Park	Plate 50
<i>Pleurotus ostreatus</i> Jacq. Druid Hill Park	Plate 51

"The flesh is hard and when eaten it requires much cooking to make it palatable. According to my own taste the 'tree oyster' is much more pleasing to the eye than to the palate. At no time have I ever been able to discover the slightest resemblance to the animal bivalve for which it is named. I have eaten it before and after cooking."

<i>Pleurotus spathulatus</i> Pers. Baltimore	Plate 52
<i>Pleurotus enosmus</i> Berk. Druid Hill Park	Plate 53

"I am very doubtful whether the plant figured is truly *P. enosmus* Berk. I have never met it since 1878."

The spores of the plant figured are represented as globose, rose colored, .00018 in. broad. The doubt is therefore well founded.

<i>Pleurotus sapidus</i> Kalchb. Druid Hill Park	Plate 54
<i>Volvaria bombycina</i> Schæff. Baltimore county	Plate 55
<i>Volvaria parvulus</i> Weinm. Western Maryland	Plate 158
<i>Pluteus cervinus</i> Schæff. * Western Maryland	Plate 157

<i>Clitopilus Orcella</i> Bull.	Baltimore county	Plate 56
<i>Pholiota rubecula</i> n. sp.	Baltimore	Plate 57

"Pileus fleshy, dry, smooth, glossy, expanded, in age centrally depressed, subrufescent, margin involute; lamellæ adnate, not distant, reddish-brown; stem solid, equal. At the roots of trees or on the ground. July to November."

<i>Pholiota mollicula</i> n. sp.	Druid Hill Park	Plate 170
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"Pileus fleshy, smooth, hygrophanous, whitish, deepened into yellow at the disk, flesh moist, even, wet so that the plant withers rapidly; lamellæ close or crowded, emarginate, white, turning cinnamon color in age; stem stuffed, then hollow, pubescent, at length smooth, white, regular; annulus large, white; spores, .0002 x .0003 in. ferruginose, somewhat irregular.

"In woods at roots of trees. The plant is difficult to dry, nearly always rapidly devoured by insect larvæ and falls out of shape from excessive moisture."

<i>Pholiota dura</i> Bolt.	Frederick county	Plate 58
<i>Pholiota præcox</i> Pers.	Frederick county	Plate 59
" "	" "	Plate 159
<i>Pholiota adiposa</i> Fr.	Carroll county and Baltimore	Plate 60
<i>Inocybe subindica</i> n. sp.	Frederick county	Plate 61

"Pileus at first campanulate, obtuse, dry, cracked longitudinally, glossy, fleshy at the disk, thin at margin, flesh white or slightly pinkish; lamellæ adnate, close, forked, lanceolate, cream color, turning brownish ochre; stem nearly regular, twisted, marked with reddish fibrils, stuffed, hard, brittle.

"In open places in woods. August and September."

<i>Inocybe lanuginosa</i> Fr.	Druid Hill Park	Plate 63
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"For five years this plant appeared regularly in July and August under a group of cedar trees."

<i>Naucoria semiorbicularis</i> Bull.	Baltimore	Plate 64
<i>Crepidotus mollis</i> Schaef.	Eastern Maryland	Plate 65
<i>Agaricus campestris</i> L.	Druid Hill Park	Plate 66
<i>Agaricus comptulus</i> Fr.	Eastern and Western Maryland	Plate 67
<i>Agaricus silvaticus</i> Schaef.	Druid Hill Park	Plate 68
<i>Hypholoma appendiculatum</i> Bull.	Frederick county	Plate 69
<i>Hypholoma Candolleianum</i> Fr.	Frederick county	Plate 72
<i>Hypholoma subaquilum</i> n. sp.	Druid Hill Park	Plate 155

"Pileus brown, convex, smooth, hygrophanous, often shaded into ochre at margin, veil delicate, silk-like, encircling and covering the marginal extremities of the lamellæ but forming no ring on the stem, flesh white, turning umber when cut; lamellæ adnexed or nearly free, close, forked, umber; stems cæspitose, regular, hollow, silky, white, two to three inches long; spores brown, .00016 x .0002 inch."

Hypholoma perplexum *Pk.* Baltimore Plate 70

This is probably a mere variety of *H. sublateritium* Schæff.

Hypholoma fasciculare Huds. Baltimore..... Plate 71

Coprinus virgineus *n. sp.* Maryland..... Plate 160

"Pileus ovate, campanulate or cylindrical, pale ochre, the margin thin, torn, floccose; lamellæ narrow, close, forked, at first white, turning dark but never black, adnexed; stem three and a half inches long, stout, somewhat stuffed, attenuated where it meets the pileus, flattened, floccose; spores black.

“Caespitose or gregarious at the roots of trees or about old stumps. Also found in Virginia.

"The plant is not rapidly deliquescent, remaining perfect for some hours."

Coprinus atramentarius Bull. Druid Hill Park Plate 71

Coprinus comatus Fr. Baltimore Plate 74

Coprinus micaceus Fr. Baltimore county..... Plate 75

Coprinus plicatilis Fr. Western Maryland..... Plate 161

Paxillus pannuoides Fr. Maryland..... Plate 76

“ “ “ Plate 77

"The two plants figured are the same in character though they differ in color and shape. Both were found on barrel hoops in the same cellar."

Hygrophorus chlorophanus Fr. Baltimore Plate 78

Lactarius alpinus *Pk.* Western Maryland Plate 79

Lactarius uvidus Fr. Eastern and Western Maryland... Plate 80

Lactarius insulsus Fr. " " " " ... Plate 81

Lactarius Indigo Schw. Baltimore county. Plate 82

Lactarius piperatus Fr. Common Plate 83

Lactarius volemus *Fr.* Baltimore Plate 84

“ “ “ Plate 85

“This plant was plentiful in July, 1877, and uniformly slender, as represented in plate 84. In 1878 it was also plentiful but large, as shown in plate 85. * * This plant is edible and makes an agreeable dish in the culinary department. I tried it stewed in beef gravy which it greatly improved in flavor. When eaten raw it is pleasant to the taste. Both the flesh and the milk turn brown upon exposure to the air.”

<i>Lactarius pyrogalus Fr.</i>	Howard and Carroll counties . .	Plate 86
<i>Russula atropurpurea Pk.</i>	Eastern and Western Maryland	Plate 87
<i>Russula foetens Fr.</i>	Eastern and Western Maryland . . .	Plate 88
<i>Russula viridipes n. sp.</i>	Baltimore	Plate 89

"Pileus dull verdigris green somewhat mottled with a darker shade, flesh brittle, white, unchanging, taste extremely acrid, margin inflexed; lamellæ meet the stem, dingy ochre or pale buff, narrow, forked, the short ones apparently anastomosing; stem hollow, 1 to 2 inches high, tapering at base, enlarged at the apex, smooth, a brighter green than the pileus; spores .00032 in.

"This fungus has very little moisture though gathered after a heavy rain. At first I thought it was *Lactarius viridis* Fr., but there was no milk. Have not met with it since."

The figure has the appearance of *Lactarius atroviridis* Pk.

<i>Russula emetica Fr.</i>	Baltimore	Plate 90
<i>Russula virescens Fr.</i>	"	Plate 91

"Very variable in color as well as in size. Sometimes it is green as represented in the figure, then greenish ochre, or yellowish white tinged with green. It is very easy to dry except in wet weather, and even then when kept in a warm dry room."

The plant figured is a variety having a thin striate acute margin.

<i>Russula alutacea Fr.</i>	Baltimore	Plate 92
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"Taste mild and agreeable. * * I have good reason for placing our American plant among the edible species, for I ate a portion without ill effect."

<i>Russula rubra Fr.</i>	Baltimore	Plate 93
<i>Russula lepida Fr.</i>	Anne Arundel county	Plate 94
<i>Russula variata Banning.</i>	Baltimore	Plate 95
<i>Russula cinnamomea Banning.</i>	Baltimore	Plate 96
<i>Cantharellus floccosus Schw.</i>	Carroll county	Plate 97
<i>Cantharellus cibarius Fr.</i>	Druid Hill Park	Plate 98
<i>Cantharellus cinnabarinus Schw.</i>	Druid Hill Park	Plate 99
<i>Marasmius rotula Fr.</i>	Carroll county	Plate 100
<i>Marasmius oreades Fr.</i>	Frederick county	Plate 101
<i>Lentinus lepideus Fr.</i>	Druid Hill Park	Plate 102

The figure represents a form with branching stem.

<i>Lentinus strigosus Schw.</i>	Knoxville	Plate 162
<i>Lenzites Cookei Berk.</i>	Maryland	Plate 163
<i>Panus strigosus B. & C.</i>	Eastern Maryland	Plate 103

<i>Boletus ornatipes</i> <i>Pk.</i>	Baltimore.....	Plate 104
<i>Boletus Peckii</i> <i>Frost.</i>	Baltimore county.....	Plate 106
“ “	Druid Hill Park.....	Plate 113
<i>Boletus felleus</i> <i>Bull.</i>	Baltimore.....	Plate 107

“In 1886 I found this fungus in Virginia measuring 18 inches across the pileus.”

<i>Boletus ignoratus</i> , <i>n. sp.</i>	Druid Hill Park.....	Plate 108
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“Pileus convex, viscid, bright lemon color, marked with rugose lines of orange color, which are distributed over the pileus giving it a streaked appearance, flesh white, solid, does not change color when cut or broken, taste slightly acid; pores lemon color, moderately large, free, connected with the stem by web-like filaments; stem larger at the apex, somewhat tapering toward the base, yellow, smooth, solid; spores .00018x.00044 in.”

This closely approaches *Boletus unicolor* Frost, from which it scarcely differs except in its white flesh and free tubes.

<i>Boletus affinis</i> <i>Pk.</i>	Eastern and Western Maryland.....	Plate 109
<i>Boletus eximius</i> <i>Pk.</i>	Druid Hill Park.....	Plate 110

This is *Boletus robustus* Frost, of which the name is preoccupied.

<i>Boletus luridus</i> <i>Fr.</i>	Druid Hill Park.....	Plate 111
“ “	Howard county.....	Plate 112
<i>Boletus Russellii</i> <i>Frost.</i>	Baltimore.....	Plate 114

“One of the plants, as shown in the figure, had *Polyporus splendens* and what I took to be *Nyctalis asterophora* growing upon the pileus.”

It is certainly remarkable to find two species of fungi growing upon one pileus, and that too before the pileus was much decayed.

<i>Boletus subtomentosus</i> <i>L.</i>	Eastern and Western Maryland.....	Plate 115
<i>Boletus modestus</i> <i>Pk.</i>	Eastern Maryland.....	Plate 116

“The plant figured is a monstrosity, which seemed undecided whether to remain a *Boletus* or to become an *Agaric*. Its hymenium was decidedly lamellated on one side nearly to the margin; all other sides were lamellated only as the tubes neared the reticulated stem.”

<i>Strobilomyces strobilaceus</i> <i>Berk.</i>	Baltimore county....	Plate 105
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This is *Boletus strobilaceus* Scop.

<i>Polyporus Beattiei</i> <i>Banning.</i>	Druid Hill Park.....	Plate 118
<i>Polyporus tomentosus</i> <i>Fr.</i>	Baltimore.....	Plate 119

<i>Polyporus splendens</i> <i>Pk.</i>	Druid Hill Park.....	Plate 120
<i>Polyporus applanatus</i> <i>Fr.</i>	Baltimore... ..	Plate 121
<i>Polyporus cinnabarinus</i> <i>Jacq.</i>	Baltimore county.....	Plate 122
<i>Polyporus parvulus</i> <i>Klotsch.</i>	Baltimore.. ..	Plate 123
<i>Polyporus rimosus</i> <i>Berk.</i>	Western Maryland	Plate 124

"Found on *Acacia* trees. It is valuable for retaining fire, and is much used by the colored people. One specimen will last a whole night to build fires and light their pipes."

<i>Polyporus sulphureus</i> <i>Fr.</i>	Baltimore county.....	Plate 125
<i>Polyporus versicolor</i> <i>Fr.</i>	Common.....	Plate 126
<i>Polyporus pergamenus</i> <i>Fr.</i>	Common.....	Plate 127
<i>Polyporus nidulans</i> <i>Fr.</i>	Druid Hill Park	Plate 128
<i>Polyporus poripes</i> <i>Fr.</i>	Halls Spring	Plate 129
<i>Polyporus Curtisii</i> <i>Berk.</i>	Druid Hill Park.....	Plate 130
<i>Polyporus lactifluus</i> <i>Pk.</i>	Druid Hill Park	Plate 131

"The flesh when cut exuded a white milk profusely."

<i>Merulius lachrymans.</i>	Maryland	Plate 132
<i>Fistulina hepatica</i> <i>Fr.</i>	Halls Spring	Plate 133
<i>Hydnum rufescens</i> <i>Pers.</i>	Lutherville	Plate 134

"It is found most plentiful in pine and oak woods, solitary or gregarious, often inclined to grow in circles."

<i>Hydnum repandum</i> <i>L.</i>	Baltimore.....	Plate 135
<i>Hydnum imbricatum</i> <i>L.</i>	Halls Spring.....	Plate 136
<i>Hydnum cæspitosum</i> <i>n. sp.</i>	Carroll county.....	Plate 137

"Pileus yellow or very pale ochre, dry, eccentric; aculei short, decurrent, very pale ochre; stem solid, cream color; flesh turns yellow when cut."

"It grows in clusters at the roots of trees and near old stumps."

<i>Irpex lacteus</i> <i>Fr.</i>	Maryland	Plate 164
<i>Craterellus pistillaris</i> <i>Schæff.</i>	Druid Hill Park	Plate 138
<i>Craterellus cornucopioides</i> <i>Fr.</i>	Druid Hill Park.....	Plate 139
<i>Corynites Ravenlii</i> <i>B. & C.</i>	Baltimore county.....	Plate 140

"This plant is now placed in the genus *Mutinus*."

<i>Phallus Dæmonum</i> <i>Rumph.</i>	Druid Hill Park.....	Plate 141
<i>Phallus impudicus</i> <i>L.</i>	Druid Hill Park.....	Plate 142
<i>Geaster fimbriatus.</i>	Baltimore	Plate 143
<i>Geaster saccatus</i> <i>Fr.</i>	} Frederick county	Plate 166
<i>Geaster striatus</i> <i>DC.</i>		
<i>Geaster triplex</i> <i>Jungh.</i>		
<i>Lycoperdon cyathiforme</i> <i>Bosc.</i>	Maryland	Plate 144

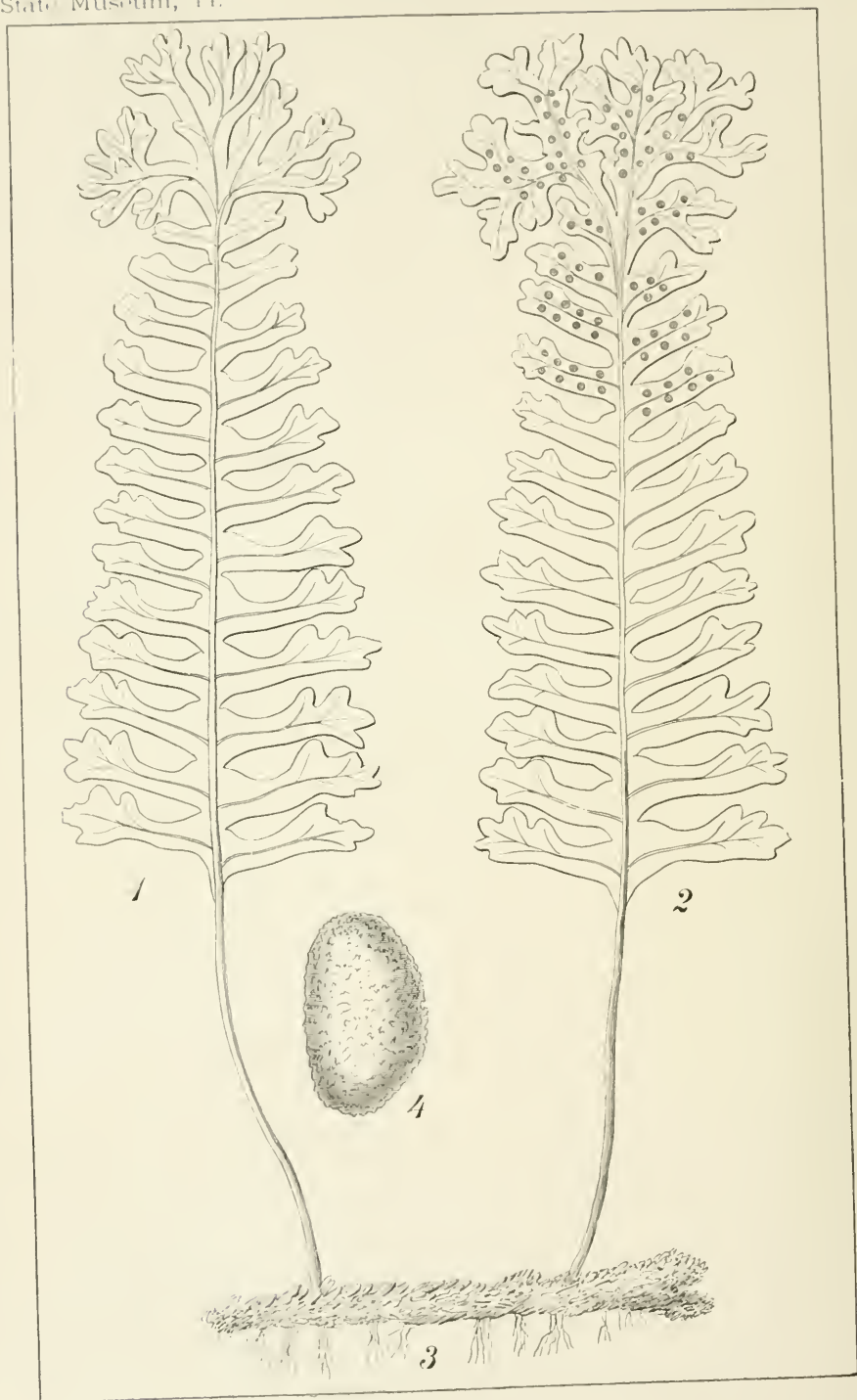
<i>Lycoperdon gemmatum</i> Batsch.	Baltimore.....	Plate 145
<i>Lycoperdon pyriforme</i> Schæff.	Common.....	Plate 147
<i>Lycoperdon giganteum</i> Batsch.	Common.....	Plate 167
<i>Lycoperdon Frostii</i> Pk.	Carroll county.....	Plate 148
<i>Scleroderma vulgare</i> Fr.	Blue Ridge Mountains.....	Plate 146
<i>Cyathus vernicosus</i> DC.	Lutherville.....	Plate 149
<i>Crucibulum vulgare</i> Tul.	Common.....	Plate 150
<i>Hypomyces Banningii</i> Pk.	Baltimore.....	Plate 151
<i>Hypomyces lactifluorum</i> Schw.	Lutherville.....	Plate 152
<i>Xylaria polymorpha</i> Grev.	Druid Hill Park.....	Plate 153
<i>Hirneola auricula-Judæ</i> Berk.	Common.....	Plate 165
<i>Morchella esculenta</i> Pers.	Western Maryland.....	Plate 168
<i>Helvella crispa</i> Fr.	Druid Hill Park.....	Plate 169

Plates 62, 87 and 117 represent species unnamed or unidentified.

Plate 175 represents *Boletus Morgani* Pk., which has not yet been found in Maryland.

The species found in Maryland by Miss Banning but not included in the Volume of Illustrations are 28. Their names are as follows:

<i>Lepiota gracilentia</i> Krombh.	<i>Omphalia grisea</i> Fr.
<i>Lepiota mastoidea</i> Fr.	<i>Pluteus chrysophæus</i> Schæff.
<i>Armillaria mucida</i> Fr.	<i>Entoloma placentum</i> Batsch.
<i>Tricholoma carneum</i> Bull.	<i>Clitopilus prunulus</i> Scop.
<i>Clitocybe flaccida</i> Sow.	<i>Naucoria melinoides</i> Fr.
<i>Clitocybe dealbata</i> Fr.	<i>Stropharia semiglobatus</i> Batsch.
<i>Clitocybe metachroa</i> Fr.	<i>Panæolus separatus</i> L.
<i>Pleurotus ulmarius</i> Bull.	<i>Coprinus domesticus</i> Fr.
<i>Pleurotus algidus</i> Fr.	<i>Coprinus Hendersonii</i> Fr.



EXPLANATION OF PLATE 1

POLYPODIUM VULGARE *L.* VAR. CRISTATUM *Lowe.*

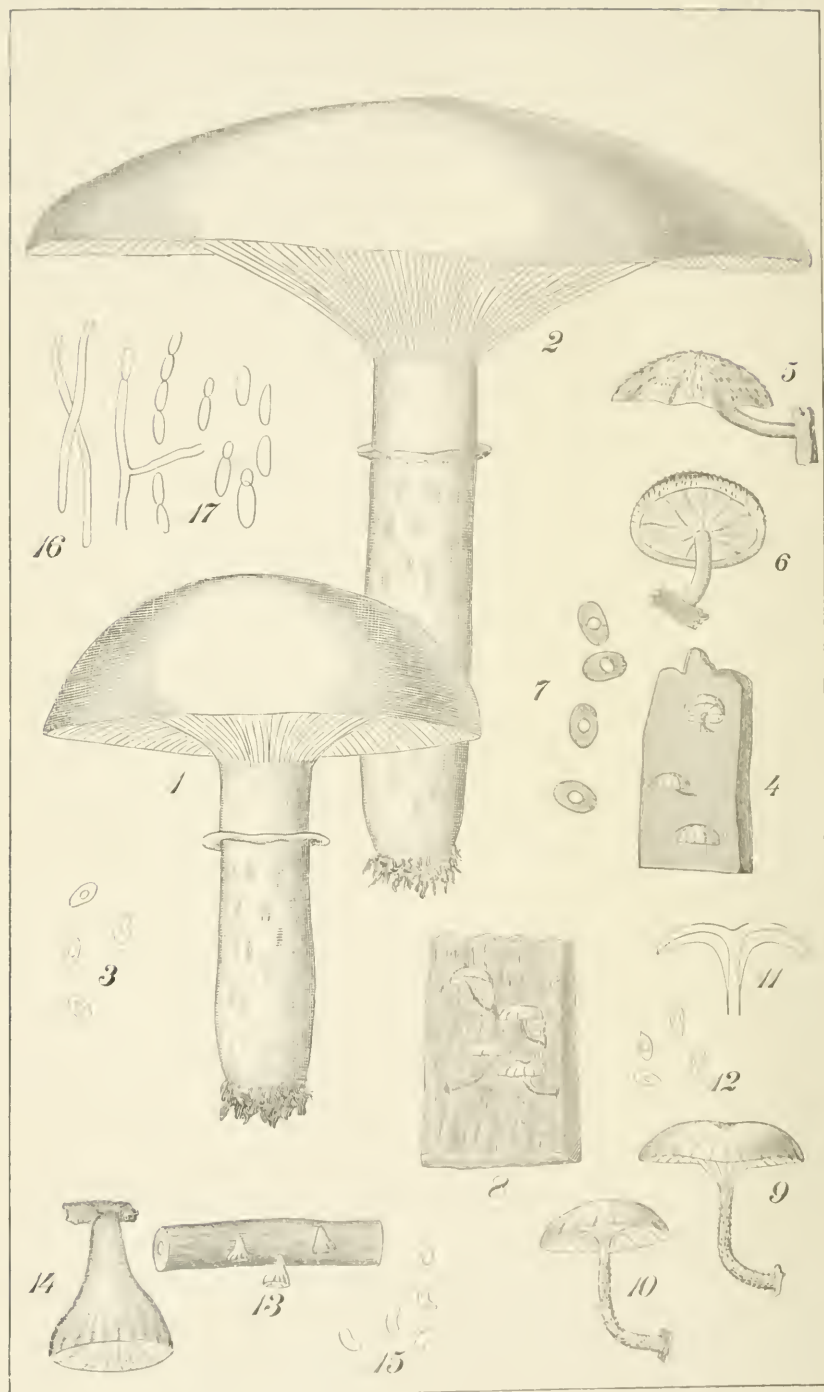
Fig. 1. A frond showing the upper surface.

Fig. 2. A frond showing the lower surface with its fruit dots.

Fig. 3. The creeping rootstock.

Fig. 4. A spore $\times 400$.





EXPLANATION OF PLATE 2

ARMILLARIA VISCIDIPES Peck.

- Fig. 1. An immature plant.
- Fig. 2. A mature plant.
- Fig. 3. Four spores x 400.

CREPIDOTUS DISTANS Peck.

- Fig. 4. Piece of bark bearing three plants.
- Fig. 5. A plant enlarged, showing the upper surface of the pileus.
- Fig. 6. A plant enlarged, showing the lamellæ.
- Fig. 7. Four spores x 400.

OMPHALIA CORTICOLA Peck.

- Fig. 8. A piece of bark bearing four plants.
- Fig. 9. A plant enlarged, showing the umbilicus of the pileus.
- Fig. 10. A plant enlarged, showing the lamellæ.
- Fig. 11. Vertical section of a pileus and the upper part of the stem.
- Fig. 12. Four spores x 400.

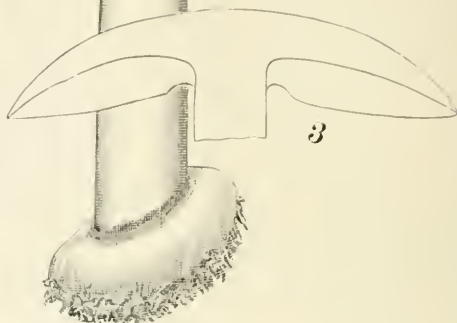
PLEUROTUS CAMPANULATUS Peck.

- Fig. 13. A branch bearing three plants.
- Fig. 14. A plant enlarged.
- Fig. 15. Five spores x 400.

SACCHAROMYCES BETULÆ Pk. & Pat.

- Fig. 16. Three hyphæ, one of them branched.
- Fig. 17. Several spores x 400.





EXPLANATION OF PLATE 3

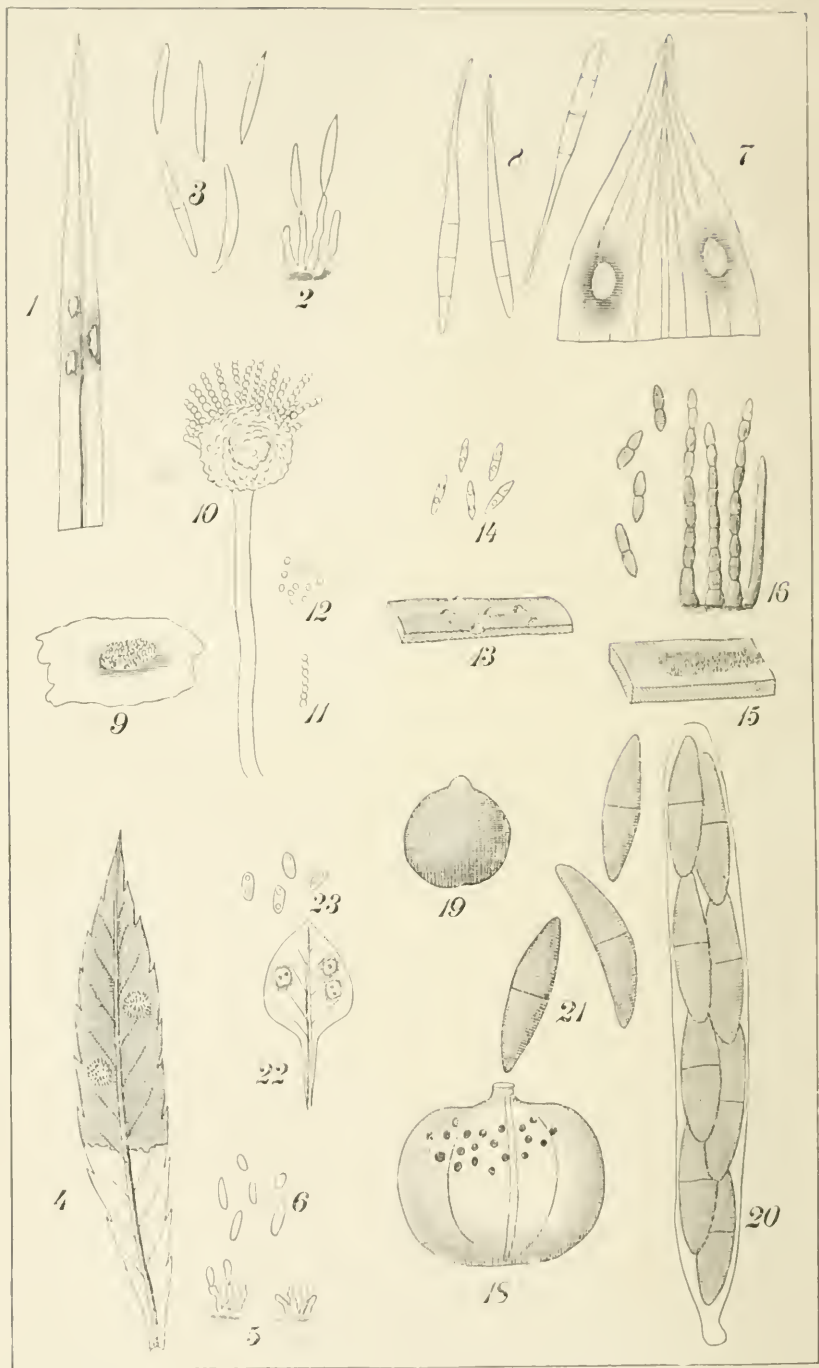
CORTINARIUS ALBIDUS *Peck.*

- Fig. 1. An immature plant.
- Fig. 2. A mature plant.
- Fig. 3. Vertical section of a pileus and the upper part of the stem.
- Fig. 4. Four spores x 400.

TRICHOLOMA GRANDE *Peck.*

- Fig. 5. An immature plant.
- Fig. 6. A mature plant.
- Fig. 7. Half of a vertical section of a pileus and upper part of the stem;
these three figures about two-thirds natural size.
- Fig. 8. Four spores x 400.





EXPLANATION OF PLATE 4

RAMULARIA GRAMINICOLA Peck.

- Fig. 1. Upper part of a grass leaf marked with three fungous spots.
Fig. 2. A cluster of four hyphæ, two of them bearing spores, x 400.
Fig. 3. Five spores x 400.

RAMULARIA DESTRUENS Peck.

- Fig. 4. A leaflet with the upper half blackened by the fungus and showing two fungous spots.
Fig. 5. Tufts of hyphæ, two filaments bearing spores, x 400.
Fig. 6. Six spores x 400.

CERCOSPORELLA VERATRI Peck.

- Fig. 7. Upper part of a leaf with two fungous spots.
Fig. 8. Three spores x 400.

ASPERGILLUS AVIARIUS Peck.

- Fig. 9. Piece of membrane bearing a patch of the fungus.
Fig. 10. A spore-bearing vesicle and its filament, the former partly denuded of its chains of spores, x 400.
Fig. 11. A single chain of spores x 400.
Fig. 12. A group of free spores x 400.

SEPTOMYXA CARPINI Peck.

- Fig. 13. A piece of bark bearing six heaps of spores.
Fig. 14. Five spores x 400.

BISPORA EFFUSA Peck.

- Fig. 15. Piece of wood bearing a patch of the fungus.
Fig. 16. Three chains of spores and a sterile hypha x 400.
Fig. 17. Four free spores x 400.

CARYOSPORA MINOR Peck.

- Fig. 18. A hickory nut bearing a group of the perithecia.
Fig. 19. A perithecium enlarged.
Fig. 20. An ascus containing spores x 400.
Fig. 21. Three spores x 400.

PHYLLOSTICTA LUDWIGIÆ Peck.

- Fig. 22. A leaf showing three fungous spots.
Fig. 23. Four spores x 400.

REPORT
OF THE
STATE ENTOMOLOGIST
FOR THE YEAR 1890.

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REPORT.

OFFICE OF THE STATE ENTOMOLOGIST, }
ALBANY, November 30, 1890.

To the Regents of the University of the State of New York :

GENTLEMEN.—I have the honor of presenting to your board my Seventh Report on the Injurious and other Insects of the State of New York, embracing results of studies and observations made during the year 1890.

The year has not been signalized by any wide-spread and particularly injurious insect attack upon the agricultural products of the state, or by the introduction from abroad of insect pests of special economic importance, yet a large number of important subjects of study have presented themselves, most of which have received the attention due them, while of several the investigation has not advanced sufficiently far to authorize their presentation at the present time.

May I briefly refer, as in former reports, to some of the more interesting insect occurrences of the year, and to a few that seem to call for their simple record while awaiting the fuller notice to be given them hereafter.

The apple-tree tent-caterpillar, *Clisiocampa Americana* Harris, which has been noticed in the two preceding reports for its excessive abundance and injury to the foliage of apple trees, has again been destructive over a large portion of the state, but in a somewhat diminished degree. Its ravages are being more extensively met by its destruction in its early stages, and by spraying operations later. Our orchardists are slowly awakening to the absolute necessity of preserving the foliage of their trees from insect pests and fungoid diseases, if fruit-growing hereafter is to be conducted with profit. In this connection it may be proper to mention that the almost entire loss of the fruit crop the past year over a large part of the state is not attributable to insect injuries, but to a concurrence of unfavorable seasonal conditions which resulted in, or contributed largely to, various fungous attacks and unknown maladies, from the effects of which blossoms blighted or the young

fruit was cast, and the diseased foliage either fell to the ground or served no vital purpose on the tree.

This year has been the second one of exemption from the usual defoliation of elms, horse-chestnuts, plum trees, etc., by the tussock caterpillar of *Orgyia leucostigma* (Sm. Abb.). The caterpillar has been seldom seen; hardly any of the cocoons of the female bearing the conspicuous egg-deposit have been observed; and no measures have been necessary for the prevention of its ordinary injuries.

The boll-worm or corn-worm of the southern states, *Heliothis armiger* Hübn., which occasionally occurs in southern New York, through the flight hither, it is supposed, and oviposition of one of the later broods of moths, has been reported from Westchester county as seriously damaging sweet corn, in September — nearly every ear in a garden, in one instance, having been ruined by it.

A minute caterpillar having the pernicious habit of eating into the buds and blossoms of the apple tree when they first appear, or later, of burrowing into the terminal twigs, or spinning together and consuming the tender leaves, has been destructive in some of the orchards of the western part of the state. It is known, locally, as the bud-worm, and scientifically as the larva of *Tmetocera ocellana* (Schiff.). Its injuries are preventable by early spraying — in advance of the time of blossoming.

From the unusual number of inquiries received from orchardists of the apple-leaf *Bucculatrix*, *Bucculatrix pomifoliella* Clemens, it is apparent that this insect is rapidly multiplying within our borders, and that effort should be made to check its increase before it shall have become generally distributed. It is not difficult to control by methods that have been already pointed out.

Another of the interesting assemblages within dwelling-houses of a small fly, named and described in a former report as *Chloropisca prolifica* Osten Sacken, has been brought to my notice and been given careful study. It is but the third record of the kind for the United States — the two others being at Franklin, N. H., and Alfred Centre, N. Y. In Europe a number of similar gatherings for winter abode of an allied species have been observed and recorded within the last sixty years. The source and food-plants of the insect have been an enigma to European scientists, but the prevalent belief has been that it breeds in some of the grain-fields. From observations made the past season, it seems probable that it will soon be ascertained beyond question that the breeding-place of the fly is in the lawn grasses that surround the dwellings.

Two species of plant-eating beetles have appeared on Long Island in such remarkable and unwonted numbers, that it seemed

useless to resort to any measures for their destruction. The one was a member of the family of *Coccinellidae*, the species of which are justly regarded as highly beneficial to the agriculturist from their feeding almost exclusively upon Aphides or plant-lice. But unfortunately this species, *Epilachna borealis* (Fabr.), has won for itself an exceptionally bad reputation, and was for a long time quoted as the only leaf-eating member of a carnivorous family. A few other species—eight or ten—have since been found to be partly vegetarian in their habits, but of these about one-half the number have only been detected feeding on the spores of fungi or other vegetable growths of no economic value. At Glen Cove, L. I., *Epilachna borealis* was particularly injurious to the melon and squash, while it fed readily on any of the *Cucurbitaceæ*.

Associated with the above, in almost equal number, was a common Chrysomelid beetle, *Diabrotica 12-punctata* (Oliv.), of broad distribution throughout the United States, and hitherto reported as injurious to corn, particularly in some of the western states where its larvæ have infested the roots of the young plants to such an extent as to impair the crop fully 75 per cent. It proved a great annoyance at Glen Cove in infesting the greenhouses and feeding on chrysanthemums and other flowers.

The elm-leaf beetle, *Galeruca xanthomelena* (Schrank), whose steady progress northward has been noticed in former reports, and which was announced in my Fifth Report for the year 1887, as having made its appearance at Poughkeepsie—midway between New York and Albany, has during this year (or more probable a year or two earlier) extended its range forty miles further north, being now found at Hudson—117 miles from New York and within thirty of Albany. It is already so injurious to the elms in Hudson, that its citizens have become alarmed, and in several instances have resorted to spraying with arsenites for the arrest of the threatened destruction of their shade trees.

Studies of interest and of considerable economic importance have been made upon the bean-weevil, *Bruchus obsoletus*, which, in the disclosure of unlooked for phases in its life-history and unsuspected powers for harm, have shown the need of resort to means by which the insect may be killed as soon as the crop is gathered. Far more active and earnest measures against it than have hitherto been deemed necessary, should be undertaken.

The grain aphid *Siphonophora avenæ* (Fabr.), which was reported last year as destructive in adjoining, and some of the western states, while New York was apparently free from its presence, has appeared the present seasons in portions of our state, particularly

in its south-eastern counties, and has inflicted serious injury to grain crops. During the last weeks of June numerous inquiries were received of means by which its injury to rye could be arrested. Several of these came from Columbia county, where the attack was apparently more severe than elsewhere. Complaint was also made of its presence on rye in Rensselaer county. At Canaseraga, Allegany county, it was reported as attacking oats and barley as soon as they were out of the ground in the spring. At Glen Cove, Queens county, it appeared upon the wheat after it had headed. The aggregate of injury caused by the insect was not large, for in most of the localities the aphid, after passing to the heads of the grain, was attacked by the minute parasites that persistently follow it and insert their eggs within the body of the aphid, thereby insuring its speedy death. Almost every head of grain submitted to me for examination contained the brown and distended bodies of the aphides, indicating their parasitized condition and the probable arrest within a short time, and without much further harm, of the aphid attack.

The appearance in June last, at Tivoli, N. Y., of the periodical Cicada, *Cicada septendecim*, although in limited numbers, and so far as known not elsewhere observed, was an event of unusual interest to entomologists. It was thought that all the broods that belong to the more densely populated portions of the United States were definitely known and their limits accurately defined. Of these, six pertain to the state of New York, no one of which was due the present year. The Tivoli appearance was therefore unannounced and unexpected. It could not be regarded as a residual of the brood of 1889, for this only occurs within the state on portions of Long Island, nor as an advance of the well-known Hudson river brood, due in 1894. At the present, it remains as an entomological enigma. Subsequent examinations of records may show it to be the remnant of an unrecognized brood, which in several of its recurrences may have been dwindling in numbers until it is now on the verge of extinction—a result which would naturally follow the clearing up of forest land, and the removal of the natural food of the adolescent insect—the roots of trees and shrubs.

The field collections of the year, with a few exceptions, were made at Keene Valley, in the Adirondack mountains, during the month of July and part of August. The season was not abundant in insect life. The usual profitable method of night collecting by the aid of a lantern, known as "sugaring," which in former years had yielded such large and valuable returns, gave nothing of particular value,

and indeed but little beyond a few common forms of the smaller moths. A favorably and conveniently located maple grove was selected but after devoting a number of evenings to successive fruitless rounds to the baited trees this method was abandoned. for the more remunerative one of collecting with lights at the windows. Why this should have been more productive, no reason can be given.

The field collections were quite successful, and enabled me to secure for the state collection, many more specimens than in any preceding year. Above 1,500 specimens were mounted, and labeled with locality and date of capture. In addition, there were several hundred examples of alcoholic and biological material. The Hymenoptera, for some unknown reason, were less abundant than usual, comparatively few of the order being largely represented, except the *Apidae* and *Andrenidae*. Of the Lepidoptera, *Papilio Turnus* was remarkably common upon moist ground in early July. *Limenitis Arthemis* was not rare. *Pieris oleracea* was seen frequently, flying with *Pieris rapæ*. The Argynnis were abundant in some wet meadows, among which *Argynnis Atlantis* was common. A single example of *Melitæa Phaëton* was taken. The Graptas were rare. Of the Theclas, seldom observed by me in this region, two species were taken, viz., *Thecla strigosa* and *T. Titus*. *Feniseca Tarquinius* was not uncommon: its larvæ were also collected. Of the Bombycidae, *Arctia virgo* was frequently taken within doors attracted to lights; *Callimorpha confusa* was in several instances driven up from the grass in meadows, about the first of August; and the larvæ of *Orgyia nova* were found in a number of examples on low willows by the river side.

In the Diptera, the *Tipulæ* were unusually abundant, as were also the *Tabanidæ*. Only a few specie of *Syrphidæ* were collected, and it was a surprise that more were not abroad, although a month later would no doubt have given much larger representation.

Of the Coleoptera, *Cicindela repanda* occurred in large numbers in the roadway. From a sandy ditch beside the road, it could be driven up in flocks and gathered into the net; other species of the genus were only seen in occasional examples. *Lina scripta* was quite abundant in its larval and pupal stages, and later in its perfect form, upon willows bordering the Ausable river. I had not previously taken it in the Adirondack region. Through most of July, the large number of the light-giving *Lampyridæ* that were abroad — their leisurely flights often marked in trails of light — was an attractive feature of the evening hours.

The Odonata were not numerous in species or in individuals, with the exception of *Diplax rubicundula*, of which any desired number might have been secured, and of some of the smaller Agrioninae. Of the Calopterygina, a few examples of *Calopteryx anata*, Hagen were seen, momentarily resting on a branch beside or flitting over the water.

In the other orders the collections were comparatively small, as but few species that were new or of special interest or value were observed.

The Contributions to the Department have been from fewer individuals during the year than in some of the preceding ones. But among them is one of particular value, from the large number of specimens and the beauty of most of them. The donor, Mr. Erastus Corning, Jr., of Albany, in these successive additions (see preceding reports) to the Zoölogical Department of the State Museum, has shown a generosity and an appreciation of the educational value of the Museum, which is deserving of more than the grateful acknowledgment herewith made. The present contribution consists of one hundred and ninety-five specimens of butterflies, mainly from South America, and four hundred and seven of native butterflies and moths, largely native to the state. They have not been catalogued for the present report, as the literature for the authentic determination of the South American forms is not contained in our State Library. Whenever arrangements can be made by which the collection may be placed on exhibition, without subjecting it to the injury that would follow its exposure to continual light it will be displayed, and form an attractive feature in the Museum.

A beautifully arranged collection of American and foreign Lepidoptera, which the owner was desirous of disposing of at a moderate price, has been purchased for the state and is now in the office of the entomologist. It consists of ten hundred and thirty-four specimens, arranged in a cabinet of eighteen drawers, of twenty-one by twenty-three inches. Among other things of special value in it, is a bisexual example of *Clisiocampa Americana*, in which the right-hand half is male, and the left-hand, female. This is shown in the pectinations of the antennæ, the disparity in size of the wings, and in the modified form of the abdomen — notably in the difference in contour of its two sides. Such examples are rarities in collections and always of great interest, and are highly valued. There is also in one of the drawers, a pair, in perfect condition, of *Cossus querciperda* Fitch, of which, it is believed, not over a half-dozen could be found in the cabinets of the world.

I regret that the pressure and confinement of office work allows me but little opportunity for field observations and studies. Could a reasonable amount of field work be done, either by myself or an efficient assistant, and so distributed over the year as to cover the period of insect activity, it would, beyond question, add materially to the value of the service that this department may render to the state. The Entomological Division of the United States Department of Agriculture, at Washington, while equipped with an office corps of a chief and eight skilled assistants, draughtsman, typewriter, and clerks, has also the aid of seven field assistants, located in six of the States. The entomologists of our state agricultural colleges and agricultural experiment stations, have, in several instances, a trained assistant, or a class of advanced students, at their command, who are rendering excellent service. The value of the work now being done in applied entomology, hardly needs to be referred to. Its results are apparent to all and have obtained the highest recognition. The agriculturist, in this time of widespread agricultural depression, appreciates as never before the aid that it is prepared to offer him, and gladly avails himself of the proffered assistance. The measure of what the state may do in this direction will be in proportion to the amount of study that it shall authorize. The field is so broad and the objects that it embraces so innumerable, that it can never be exhausted, or even an approach made to a complete garnering of its stores. The insect world, existing largely upon cultivated products which are essential to the life or well-being of man, is brought into such intimate relations in its state of continual antagonism to him, that it may be safely asserted that of no other branch of the animal kingdom is the study of equal utilitarian value.

With direct reference to my own official work: there is no doubt but that its value to the state could be more than doubled by the assignment to the Office, of a skilled assistant or one who might soon be trained to serve in that capacity. It is neither economical nor just to the department, that the entomologist should be obliged to devote so large a portion of his time to simple clerical duties, while there remain important studies to complete and arrange for presentation in such form that they may accomplish the purpose for which they were undertaken, and others, that he is desirous of entering upon at the earliest opportunity.

In the Appendix, will be found a paper read by the Entomologist before the Western New York Horticultural Society at its January

meeting, which, in part, supplements the necessarily hurried report presented to your board for the preceding year (1889).

A list of publications by the Entomologist during the year (sixty-one in number), most of which were contributed to agricultural journals in response to inquiries made of injurious insects submitted, is also contained in the Appendix, together with a similar list for the years 1878 and 1879. A list of contributions to the department for the year 1890 is also given.

In conclusion: I desire to offer my grateful acknowledgments to your honorable board for the aid and many courtesies extended to me through your Secretary, in conveniences for office work, in facilities for consulting the literature of my department contained in the State Library, and for the addition to the library of a number of volumes needed in my studies.

Respectfully submitted.

J. A. LINTNER.

INJURIOUS INSECTS.

***Aulacomerus lutescens* (Lintn.).**

The Poplar Saw-fly.

(Ord. HYMENOPTERA: Fam. TENTHREDINIDÆ.)

LINTNER: Fourth Report on the Insects of New York, 1888, pp 44-46, figs. 20-22.

In the description of the larva, its habits, the winged insect, and oviposition of this poplar saw-fly which had occurred in numbers at Albany, N. Y., it was given name as a new species upon information received from Mr. E. T. Cresson, to whom it had been submitted, that it was probably undescribed and was referable to the genus *Aulacomerus* (see page 46, *loc. cit.*).

Examples of it were subsequently sent to Mr. John G. Jack, of the Arnold Arboretum, of Harvard University, Boston. From a comparison that he was able to make with European specimens in the collection of the Cambridge Museum, and the examination of literature consulted, it seems not improbable that this saw-fly will have to assume an older European name, and add one more to our extended list of insect pests introduced from the Old World.

Mr. Jack has written to me as follows:

The other day, in looking over some specimens of European saw-flies in Dr. Hagen's Collection, I was struck by the similarity of the manner of oviposition between your *Aulacomerus* and that of one of the specimens in the cabinet. My interest was aroused to look further into the matter, and after pretty careful comparisons of your specimens and description with those of *Cladius viminalis* Fallen, of Europe, I confess that I can make out but little difference, if any.

The European description and figures as given by Vollenhoven (vol. i [1858], p. 176, pl. 10, *Tijdschr v. Entomol.*), and by Cameron (*Monog. Brit. Phyt. Hymenop.*, vol. ii, p. 29, and vol. i, pl. v and xv), seem to agree with your specimens, and I can detect no essential differences between them and Brischke's specimens in the Museum Collection. Food-plants, eggs, larvæ, and imagoes all agree well.

Upon requesting Mr. Jack to compare the nervulation of the *viminalis* and *lutescens* particularly in the position of the recurrent nervules, he reports an exact agreement in the two. Unfortunately there is no

male example of *C. viminalis* in the Cambridge collection. If the male should show the peculiar structure ascribed to *Cladius* in its diagnosis as given by Cresson, viz., "basal joints of flagellum produced or branched beneath" (as appears conspicuously in our *Cladius isomera* Harris), then *A. lutescens* is assuredly distinct, for no approach to such structure is presented in its antennæ.

Mr. Jack has pointed out a discrepancy in the description and figure of *Cladius* given by Cameron, in that the former calls for four submarginal cells, while his figures of the male show but three. This, however, is but of little importance, since the nervulation in the *Tenthredinidæ* is known to vary to so great extent that it seems hardly to afford a sufficient basis for separating genera. *Aulacomerus* is one of the several genera which are based on comparatively slight differences in venation. The family certainly needs a thorough study and revision with the aid of a knowledge of the European species, with which a number of ours, will in all probability prove identical.

I have not been able to compare the life-history of *C. viminalis* with that of *A. lutescens*, but the following note of the European species has just come under observation:

In M. le Dr. Jacobs' "Tenthredines, Céphides & Siricides des Environs de Bruxelles," contained in *Comptes-Rendus des Séances de la Société Entomologique de Belgique*, 1884, xvi-xxiv, is this (p. xix):

Trichiocampus viminalis* Fallen. The larva lives in August and September, on the willow and poplar, of which it eats the under side of the leaves; the perfect insect appears in June.

Compared with the above, and essentially differing — *A. lutescens* larva feeds in June and August, resting on the *upper side* of the leaf and consuming all but the stronger ribs; the perfect insect appears at about the middle of July.

NOTE.—Just as the above is being printed, the identity of *Aulacomerus lutescens* with *Cladius viminalis* of Europe, has been determined by Mr. Peter Cameron, of Sale, Cheshire, England — an authority in European Tenthredinidæ. Examples of our species, in both sexes, were submitted to him, and he has returned answer that they are certainly *C. viminalis*. He also states that *Aulacomerus* has nothing to do with *Cladius* so far as can be made out from the description and rough figure. Mr. Cameron has also kindly sent colored figures of the European larvæ, which agree with ours.

* A genus of Hartig, separated from *Cladius* of Illiger.

Pyrrharctia isabella (Sm.-Abb.)*The Black-and-red Woolly-Bear.*

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

- SMITH-ABBOTT: Nat. Hist. Lep. Ins. Geo., ii, 1797, pl. 66; as *Phalcena*.
 HÜBNER: Verz. Bekann. Schmett., 1816, p. 184; as *Estigmene*.
 HARRIS: Cat. Ins. Mass., 1833, p. 591; Rept. Ins. Mass., 1841, p. 59; Ins. Inj. Veg., 1862, p. 355, f. 170; as *Arctia*.
 GOSSE: in Canad. Nat., 1840, pp. 78, 308.
 EMMONS: Nat. Hist. N. York—Agricul., v, 1854, p. 229 (description and habits; as *Arctia*).
 WALKER: Cat. Br. Mus.—Lep. Heteroc., iii, 1855, p. 611; as *Spilosoma*.
 CLEMENS: in Proc. Acad. Nat. Sci. Phila., xii, 1860, p. 531; Appen. to Morris Synop. Lep., 1862, p. 352; as *Spilosoma*.
 MORRIS: Synop. Lep. N. Amer., 1862, p. 340; as *Arctia*.
 SAUNDERS: Synop. Canad. Arct., 1863, p. 16; in Canad. Journ., viii, 1863, p. 364; in Canad. Ent., i, 1869, p. 26; id., v, pp. 75-77, f. 14; as *Spilosoma*; in Rep. Ent. Soc. Ont. for 1873, p. 22; f. 15; as *Pyrrharctia*.
 PACKARD: in Proc. Ent. Soc. Phila., iii, 1864, p. 121; as *Pyrrharctia isabella* and *P. Californica*; in 4th Rept. Peab. Acad. Sci. 1872, p. 86; as *P. Californica*.
 RILEY: in Amer. Entomol., i, 1870, p. 48; id., ii, p. 182, f. 112; 4th Rept. Ins. Mo., 1872, p. 143, f. 65; in Amer. Entomol.—Bot. iii, p. 133, f. 51 (life-history); as *Arctia*; Gen. Ind. Mo. Repts., 1881, p. 55; as *Pyrrharctia*.
 EDWARDS H.: in Proc. Cal. Acad. Sci., v, 1873, pp. 187, 370; as *Pyrrharctia*.
 MOESCHLER: in Stett. Ent. Zeit., 1876, pp. 37, 297; as *Pyrrharctia*.
 FRENCH: in Trans. Dept. Agricul. Ill., xv, 1877, p. 182.
 MANN: in Psyche, ii, 1878, p. 270; as *Spilosoma*.
 MARTEN: in Trans. Dept. Agricul. Ill., xviii, Appen. 1880, p. 115.
 COLEMAN: in Papilio, ii, 1882, p. 18; as *Pyrrharctia*.
 WEED: in Papilio, iii, 1883, p. 84; as *Pyrrharctia*.
 BEAN: in Canad. Ent. xvi, 1884, p. 67; as *Spilosoma*.
 SMITH: in Amer. Entomol., ii, 1886, p. 79; in Canad. Entomol., xli, p. 103 (bibliography); as *Pyrrharctia*.
 DIMMOCK, A. K.: in Psyche, iv, 1888, p. 281; as *Spilosoma*.
 LINTNER: in Count. Gent., lv, 1890, p. 941 (general notice).
 DYAR: in Psyche, v, 1890, p. 422 (number of stages).

This insect, as the result doubtless, of the perils attendant upon its exposure to its many enemies during its not closely-hidden winter's sleep, is never multiplied to such an extent as to give it rank among our serious insect pests; yet the caterpillar is frequently encountered in the latter months of the year, and often excites curiosity, as may appear from the following inquiry:

Could you kindly give myself and others some information about the caterpillars sent herewith? Just now they are crawling in all directions, apparantly seeking warm quarters for the winter, as they all appear to be wending their way towards buildings of some sort.

Everybody walks over them, but few, I think, stop to inquire about their life-history or habits, or whether they are harmful or otherwise. I notice chickens eye them curiously, but will not devour them, presumably on account of their hirsute covering. J. H. C.

MORETON FARM, N. Y., October 15.

To the above the following reply (some additions thereto are inclosed in brackets) was made, through the *Country Gentleman*, of November 28th of the present year:

Traveling Habit of the Caterpillar.

The caterpillars sent are the common red-and-black "woolly-bears," known to science as *Pyrrharctia isabella*. It is very seldom that it occurs in such numbers as reported above, but it may be seen almost every year during the autumn months, traveling over roadways and along foot-paths, en route to some suitable place for its winter quarters. Its remarkably rapid gait would indicate extreme haste to find the desired shelter, but if followed, it would be seen to consume hours of time in unnecessary travel, as if in obedience to some requirement in its economy, or simply for the pleasure that the exercise may afford.

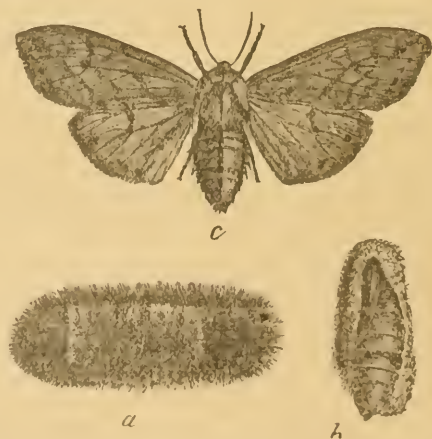


FIG. 1.—The Isabella tiger-moth. *PYRRHARCTIA ISABELLA*: a, its larva; b, its cocoon opened to show the pupa.

The Caterpillar Described.

Nearly all who have had the privilege of passing their childhood in the country—where nature may be so conveniently studied and ever appeals to the inquiring eye—are familiar with the class of caterpillars known from their thick-set hirsute clothing as "woolly-bears." This particular one is the most common of all throughout the eastern part of the United States. When full-grown it measures an inch and

one-half in length. Its black body is thickly covered with long, stiff, barbed, spine-like hairs, which are of even length like close-cut bristles of a brush. The first four segments (of the twelve in which the body of caterpillars are divided) are black, as are also the last two, while the intermediate ones are red or chestnut-brown. If taken in the hand or arrested in its journeyings with a stick or the foot, it rolls itself up in a ring, almost as tightly as the armadillo is reported to do, and for the same purpose—to protect itself from harm, or possible only as an inherited instinctive act. From this habit it has been given the name by which it is known in some of the western states, of “the hedge-hog caterpillar.” It is represented in Fig. 1, at *a*.

Transformations of the Insect.

At this season of the year (autumn) the caterpillar is not fully matured. It therefore retires, upon the approach of freezing weather, to some concealed place, as in an old stone wall, within a wood-pile, or under a board, where, rolled in a ring or doubled up like a bear, it may pass the winter in a semi-torpid state. Here it remains, unless a succession of warm days should draw it temporarily from its retreat, until the warmth of spring arouses it again into activity.

It comes abroad and feeds for a while on almost any garden or other succulent plant that it finds conveniently at hand. It is soon full-fed and in readiness in April or May for its transformations.* Again it retires to shelter, when it incloses itself within a dark-colored oval cocoon, consisting of a silken thread that it spins into a firm web about it, interwoven with the hairs rubbed or plucked from its body. The cocoon torn open, showing the pupa within, is represented in the above figure, at *b*.

Within the cocoon it throws off its caterpillar skin and becomes a shining black, blunt-ended pupa. When ready for its final change the pupal case is rent by the movements of the imprisoned insect, and the moth emerges. Within a half-hour, with expanded and dried wings, it has become a perfect creature, prepared for flight, and for seeking the companionship of its mate. This last stage usually occurs during the months of June or July.

The Moth Described.

The moth is not conspicuous in coloring. Its wings are dull yellow or a yellow-buff, with a few black dots and two or three indistinct brownish lines crossing the outer half of the front pair. The hinder

[* Mr. H. G. Dyar reports, as the result of his observations upon this insect, that the larva undergoes nine moltings before pupation—the largest number in twenty-eight species of *Bombycidae* of which he has recorded the stages—five being the usual number.]

pair of wings are sometimes tinged with red. The body is darker yellow, and is marked with a row of six black spots above and a similar row on each side, and two rows of smaller dots underneath. The moths measure about two inches in spread of wings.

Food of the Caterpillar.

Although the caterpillar feeds on a large number of plants, and is somewhat common, yet from its habit of keeping near the ground and confining itself principally to the lower leaves, it is far less injurious than is another of the woolly-bears, with long, uneven, yellow hairs, named *Spilosoma virginica*.

[Perhaps a rather unusual diet for it is that of feeding on other insects, but in one instance, at least, it is known to have displayed a cannibalistic taste and to have devoured the pupæ of a butterfly, *Pyrameis cardui*, which had transformed in a box in which some caterpillars of both species had been confined together. When the box was opened one of the isabellas was discovered feeding on a pupa which it had half consumed. Two had previously been eaten. An abundance of vegetable food was in the box.]

Its Natural Enemies.

It is not known to have many natural enemies; chickens and other poultry would not dare to eat it. It is occasionally parasitized by some of the ichneumon flies when its rolled-up position opens its barricade of hairs sufficiently to admit of the insertion of an egg within or upon its body. [Of these, four species have been recorded by Professor Riley, viz., *Ophion macrurum* (Linn.) *Ichneumon cæruleus* Cress., *Ichneumon signatipes* Cress., and *Trogus obsidianator* Brullé (*American Entomologist*, iii, 1880, p. 134). *Ophion arcticæ* Riley MS., has also been bred from it (*Insect Life*, iii, 1890, p. 155).]

Helophilus latifrons (Loew).

(Ord. DIPTERA: Fam. SYRPHIDÆ.)

LOEW: *Diptera Americæ Septentrionalis indig.*, Century iv, 1863, p. 73.

WALSH: in *Amer. Entomol.*, ii, 1870, p. 142, f. 94.

GLOVER: MS. Notes Journ. — *Dipt.*, 1874, p. 25, pl. 9, f. 21.

OSTEN SACKEN: *West. Dipt.*, in *Bull. U. S. G.-G. Surv.*, iii, 1877, pp. 321, 337; in *Bull. Buf. Soc. Nat. Sci.*, iii, 1877, p. 57; *Cat. Dipt. N. A.* 1878, p. 134.

WILLISTON: in *Proc. Amer. Philosoph. Soc.*, xx, 1882, p. 324; *Synop. N. A. Syrph.*, in *Bull. 31. U. S. Nat. Mus.*, 1886, p. 188 (detailed description).

LINTNER: *Rept. St. Entomol. for 1885*, in 39th *Rept. N. Y. St. Mus. Nat. Hist.*, 1887, p. 102-3 (as *H. similis*).

SMITH: *Catalogue Ins. N. J.*, 1890, p. 386.

The Family of Syrphidæ.

The family of flies known as *Syrphidæ*, from one of its principal genera, *Syrphus*, is one of the largest among the Diptera,* and consists largely of gayly colored and prettily ornamented flies, which from their habit of frequenting the sweet-scented flowers of the golden-rods, asters, the Canada thistle, etc., are popularly known as "flower flies." They are often to be seen in the bright sunshine of July and August poised on rapidly vibrating wings, like the hawk moths and humming birds, over or near the blossoms that they frequent, and like them, suddenly darting away, if alarmed. From their peculiar motion, some of the English writers discourse of them under the appropriate name of "hover-flies." A prominent color among them is a brilliant yellow, displayed in conspicuous bands and spots and lines. Some of the species show a striking resemblance to bees, wasps, and hornets, and are doubtless often mistaken for them. Any one not an entomologist, upon being shown a specimen of *Volucella evecta* Walker, or of *Eristalis flavipes* Walker, would, without hesitation, pronounce it a bumble-bee. *Temnostoma alternans* Loew, might easily at a little distance, even by one familiar with insects, be confounded with the irascible little "yellow-jacket," *Vespa diabolica* Sauss. I have seldom taken the large and beautiful *Spilomyia fusca* Loew from the blossoms of the Clematis without looking closely to see whether it were not the white-faced hornet, *Vespa maculata*. The rare *Ceria abbreviatella* Loew has been brought to me from the trunks of the balsam poplar, as a prettily marked wasp showing a peculiar running habit: its resemblance to *Odynerus Philadelphice* Sauss., is strikingly marked in its two yellow abdominal bands, the yellow lateral spots of the thorax, the yellow-spotted scutellum, the length of the antennæ, and in size. *Eristalis tenax* (Linn.), so closely mimics the drone of the honey-bee that in Europe it is known as the "honey-bee fly."

Although so large and attractive a family, very little has been learned of the larvæ of these flies and their early history. A wonderful range of diversity prevails in their appearance, habitat, food, transformations, and habits, which will afford an ample and interesting field for study. In consideration of the excellent monograph of the *Syrphidæ* recently prepared by Dr. Williston, at the request of the Smithsonian Institution and published by the Department of the Interior, we may expect that increased attention will henceforth be given to this interesting family.

*About two thousand species are catalogued from the whole world, of which over three hundred are from North America north of Mexico.

The following is offered as a slight contribution to the natural history of *Helophilus latifrons*.

A Correction.

This insect was noticed in the Report of the Entomologist for the year 1885, *loc. cit. sup.*, under the name of *Helophilus similis* Macquart — the result of erroneous determination of the specimens in my cabinet.



FIG. 2.—*HELOPHILUS LATIFRONS*, enlarged.

The two species bear so close a resemblance to one another that prior to the detailed and comparative descriptions given by Dr. Williston, examples in collections were often incorrectly named. The principal structural difference is to be found in the comparative breadth of the front in the males; the other differences as indicated by Baron Osten Sacken, are mainly colora-

tional. A ready means of separating the species is offered in the form of the lateral black stripes of the thorax, which are less heavy in *latifrons*, and terminate in a point on the anterior and posterior margins, while in *similis* they appear to be continued broadly over them. The last-named species is also a stouter form, having a comparatively broader thorax and abdomen. *H. latifrons* is represented in figure 2, and *H. similis* in figure 3.



FIG. 3.—*HELOPHILUS SIMILIS*, enlarged.

Habitat of the Larva.

Examples of the larvæ of *H. latifrons* were received in 1885, from Dr. R. H. Morey, of Old Chatham, N. Y., who, attracted by the singular appearance of their rat-tail like appendage, had taken them from a water-tank in Nassau, N. Y. They were numerous at the time, July fourth, but when a week later additional examples were asked for, only a half dozen could be found — all but these having left the water and gone elsewhere for pupation.

The Mature Larvæ.

The larvæ were placed in a glass of water with an inch of ground and dead vegetable matter at the bottom. They hid themselves in the ground, with their tails extended upward to the surface for respiration, to an extent of two inches, except when disturbed, when the respiratory tube would be quickly withdrawn from the surface and partly contracted.

Within the following week, some of the larvæ were found floating upon the surface of the water. As this condition was believed to indicate approaching pupation, they were transferred to a box of dampened saw-dust, into which they buried themselves.



FIG. 4.—LARVA OF *HELOPHILUS LATIFRONS*, enlarged.

At this time they presented the following features: The body was subcylindrical, narrowing somewhat anteriorly, and one-half of an inch in length by one-eighth of an inch broad; beneath, whitish, pale brown above, becoming darker toward the tail; the several segments show six divisions (as wrinkles or folds) above, of which the front one is the broadest; on segments two to seven apparently (the posterior ones not being separable) are six pairs of tubercle-like feet, which, when protruded, show each a short black spine. The head bears anteriorly two brown, slender, blunt projections, so short as to be barely visible without a magnifier. The first two joints of the dark brown tail are corrugated, and measure seven-tenths of an inch in length, with the terminal black-tipped extensile joint projecting from them one-fourth of an inch.

Other larvæ were transferred for pupation July sixteenth, eighteenth and the last on the twenty-fifth.

Pupation.

The transformation of the larva into the pupa and imago occurred within the material given it for the purpose. On the eighteenth of July, the first fly emerged; on the twenty-fifth the second appeared, and two others followed later, the dates of which were not noted. It appears from the above that the pupal stage is a brief one — of about ten days continuance.

Habits of the Larva.

My attention having recently been newly drawn to these rat-tail larvæ, request was made of Dr. Morey for such information as he might be able to give of the mode of occurrence and conduct of the company that had come under his notice in 1885. To his kindness, and habit of careful observation of animal forms which is so often associated with the advanced study and practice of medicine, we are indebted for the following interesting and valuable contribution to the history of these strange forms:

The water-tank from which the larvæ sent to you were taken, was a road-side one on the farm of my father, in the town of Nassau. It was the half of an old molasses cask or hogshead, which was fed by water running for about six rods through the old-fashioned wooden

pipe (logs), a portion of which had been there for from fifty to seventy years. The water stood in it usually at a depth of two feet. At the bottom was a sediment of light mud covered over with confervæ which also grew upon and around the sides of the tank, in all stages of growth and decay. Of the "rat-tails" — some were swimming about in the water at the depth of a foot or more below the surface; some were creeping slowly, or more often remaining quiet on the sides of the tank, also below the surface; others (perhaps a fifth part or less) were floating along with expanded end of tail at the surface, but a sudden jar would at once send them downward. They were able to remain underneath without coming up for respiration for a much longer time than the larval mosquito. They were very sluggish in all their movements. Of those resting on the sides of the tank, some were at just the height to reach the surface with the tip of their tails. A few were observed on the outside of the tub, on the shady or moist side, apparently working their way to the ground, where they burrowed into the soft, wet soil, and into some decaying portions of a willow log. It did not appear that any buried into the mud at the bottom of the tub, although it was an inch or more in depth; indeed they were seldom seen on the bottom except as they might be hanging downward from the side. It seemed to me, although I could not determine the fact, that the larvæ were feeding on the decaying confervæ in the water. The tub was partially overhung and shaded for most of the day by a willow tree standing on the opposite side of the highway.

I endeavored to procure more of the larvæ for you in 1886, but they did not make their appearance. The year following my father removed the water-tank in consequence of a diminished water supply from the old pipes, and since then, although I have kept them in mind at their usual time of coming, I have not been able to find them elsewhere.

Erroneous Larval Habits Reported.

In the *American Entomologist*, ii, 1870, pp. 141, 142, Mrs. Mary Treat in a paper entitled "Plant-lice and their Enemies," has given an account of the habit of some *Syrphus*-fly larvæ which she had reared, as minutely detailed, from eggs deposited by the parent flies among some plant-lice infesting *Chrysanthemum* slips while under glass. In an extended note upon the article, appended by the editor, C. V. Riley, he remarks as follows: "At our request Mrs. Treat has sent us some of the bred flies mentioned in this article, and among them are three species of the genus *Syrphus*, and one of *Helophilus*. The latter is the *H. latifrons* of Loew (Fig. 94)." The species, was evidently correctly identified and illustrated by Professor Riley (it is given in Fig. 5 from an electrotype furnished) but there is clearly some mistake in the matter. *Helophilus latifrons* could not have been reared from larvæ feeding on plant-lice. Its larva is aquatic only, and wholly incapable of living in the manner stated. Some error probably occurred in the examples sent by Mrs. Treat.



FIG. 5.—*HELOPHILUS LATIFRONS*, natural size. (After Riley.)

The Fly.

The fly is among the handsomest of its family. Its principal features are the three black thoracic stripes on a dull yellow ground; four large yellow spots on the sides of the abdomen above, nearly meeting on the middle of the back; and a narrow yellow band on the segment following the spots. The face is yellowish, covered with a light pile. The legs are yellow and black. The wings are hyaline. Its length is from five to six-tenths of an inch. For a detailed description the student may refer to Dr. Williston's monograph as cited.

Distribution of the Species.

H. latifrons would appear to be more particularly a western species, Baron Osten Sacken having observed it abundantly in the environs of San Francisco, Cal., and having received it from the Red River of the North. Dr. Loew's type specimens came from Nebraska. Professor Comstock has received a number of examples from Montana. Dr. Williston has examined many from the Rocky mountains and Pacific regions, while he also finds it in its eastern extension, to be the most common species of its genus in New England. I have only taken a single example of it in New York—at Keene Valley, Adirondacks, on August thirtieth—owing, perhaps, to my seldom making field collections during the late summer, when it may be of more frequent occurrence. Of its closely allied species, *H. similis* Macquart, twenty-four specimens (13 males and 11 females), were taken by me at Piseco lake, Hamilton county (Adirondack region), on the 30th and 31st of August, 1889, from the flowers of a low-growing golden rod (*Solidago*) overspreading a pasture.

Not an Injurious Species—The Syrphidæ not Harmful.

From the preceding statement of larval habits, it will be seen that the species is not an injurious one, unless the fly, in its visits to flowers, should be found justly chargeable with the injury that is suspected of *Eristalis tenax*—of soiling the petals of some delicately colored flowers.

None of the species of the *Syrphidæ* are known to be positively injurious, while many of them in their larval stage render most excellent service to the agriculturist and florist in the myriads of the destructive family of plant-lice (*Aphididæ*) that they devour, and upon which they exclusively live.

One of the species, however, *Mesograptia polita* Say, although belonging to an aphid-eating tribe, has recently won for itself the name of "the corn-feeding Syrphus-fly," from its having been found to feed as a larva, on corn. It has been detected in New Jersey, feeding, in

large numbers, on the pollen of corn; while in Florida it has been discovered in great abundance, engaged in puncturing the saccharine cells of the leaves at their base and also of the stalks, and sucking up the exuding juice. Thus far, no serious injury has been seen to result from its operations.*

Chloropisca prolifica (Osten Sacken).

The Prolific Chlorops.

• (Ord. DIPTERA: Fam. OSCINIDÆ.)

LINTNER: Fourth Rept. Ins. N. Y., 1888, pp. 67-72, f. 30; in (and from) 41st Rept. N. Y. St. Mus. Nat. Hist., 1888, pp. 187-192, f. 30; in New York Times of April 14, 1890; in Albany Daily Press and Knickerbocker, for April 15, 1890; in Plattsburgh (N. Y.) Morning Telegram, for April 23, 1890; in Country Gentleman, for May 1, 1890, iv, p. 349.

In the "Fourth Report on the Insects of New York (41st Rept. on the New York State Museum of Natural History) for the Year 1887," as above cited, an account is given of a fly that had been brought to my notice during the year, as hibernating in immense numbers in a dwelling-house, in Franklin, N. H. It was found to be an undescribed species of the *Oscinidæ*, and was accordingly given the name of *Chloropisca prolifica* Osten Sacken. Figure 6, representing it, is from a drawing made by Mr. J. Bridgham, greatly enlarged — the cross-lines beside it giving the natural size.†



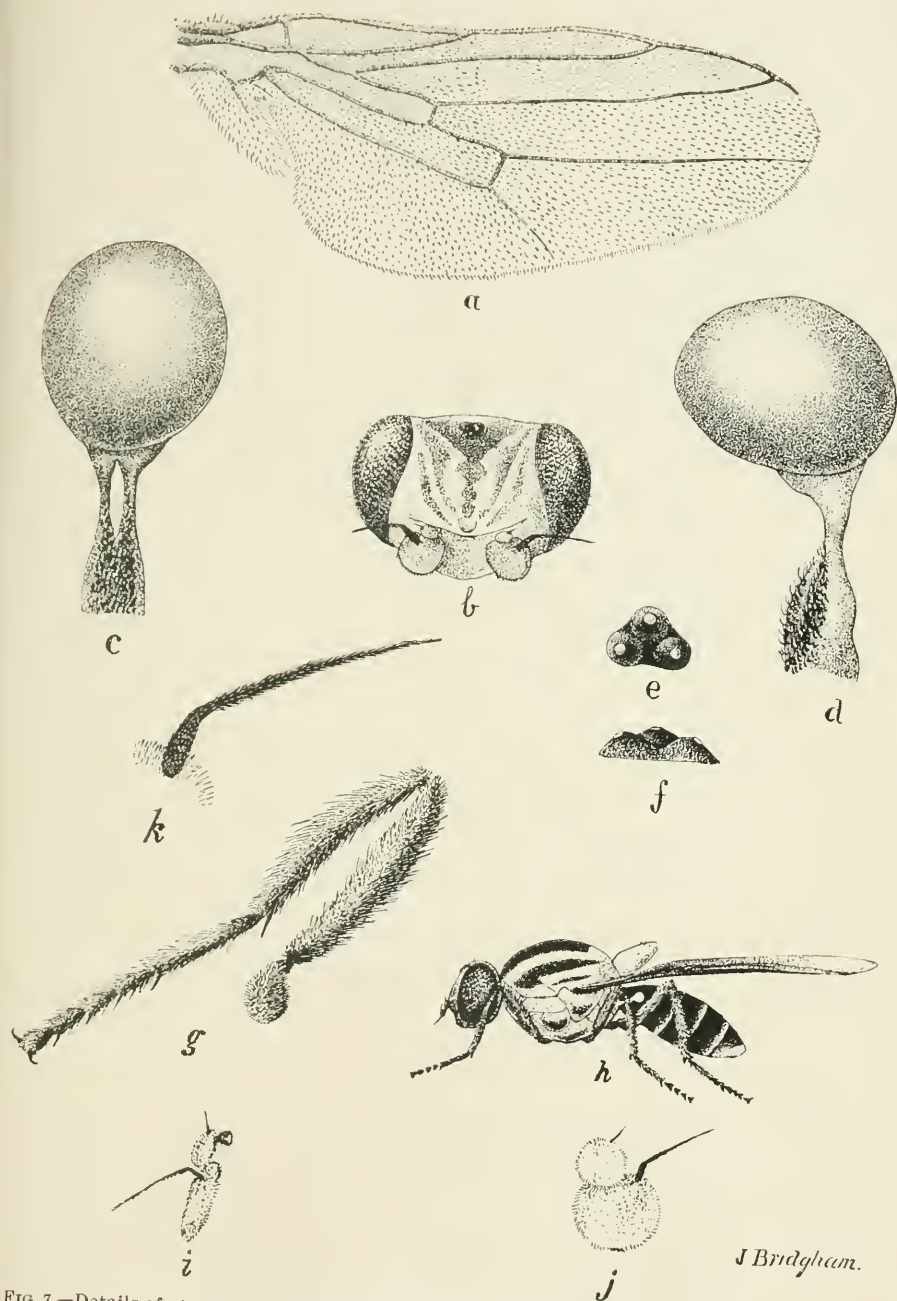
FIG. 6. — The Prolific Chlorops, *CHLOROPISCA PROLIFICA*, enlarged.

Remarkable Gatherings of the Fly.

Examination showed it to be closely allied to other species of *Oscinidæ*, which, under the generic name of *Chlorops* had been

* *Insect Life*, I, 1888, pp. 6, 7.

† The cross-lines show twice the natural size of the fly, the photo-engraver having reproduced the figure in full size of drawing, instead of reducing it to one-half, as directed.



J Bridgman.

FIG. 7.—Details of structure in different degrees of enlargement, of *CHLOROPISCA PROLIFICA*.



described and recorded as occurring in immense assemblies for their hibernation within buildings in different countries of Europe, as in England, France, Switzerland, Germany, and Russia. The flies had usually assembled during the month of September, and collected in a particular room or limited portion of a building where they passed the winter for the most part in a torpid state and in concealment, and departed in the early spring (March) for their unknown breeding grounds.

These gatherings had been deemed of such interest, from their immense numbers, amounting to many millions, the unusual features displayed in their hibernation, and the inability to trace them to their source in any of the cereal crops in which they were believed to breed, that, whenever brought to the notice of scientific men, they have always been deemed worthy of attention, and of record sometimes quite detailed.

Three Known Localities in the United States.

Another late summer gathering and winter hibernation of the same fly, in addition to the New Hampshire locality, was reported during the same year, at Alfred Center, N. Y., which is also noticed in the report above cited.

The present year, a third of these interesting occurrences, scientifically viewed, has been brought to light, which is also of the same insect, *Chloropisca prolifica*. As these three are the only ones of the kind recorded from the United States in our literature, it seems not improbable that future studies will show the fly to be a comparatively recent introduction, and identical with some of those that have long been known in Europe as possessing similar habits, but of which, although some have been referred to *Chlorops* and given specific designation, their identifications, according to Baron Osten Sacken, were not made by competent persons, and are therefore of no value whatever.

The third locality is at Ausable Forks, in northern New York, where a large company of the fly has, for the last few years, been making an annual visit to, and finding winter quarters in, the residence of Mr. H. D. Graves. For the interesting account which I am able to present of the visits of this insect, I am indebted to the kindness and courtesy of Mrs. Graves, as shown in her readiness to give me any desired information, and to extend aid in endeavoring to discover the source of her intrusive and unwelcome guests.

The following account is compiled from the several letters received from her upon the subject.

Mrs. Graves' Account of the Fly.

Its first notice.—The first appearance of the fly was in the last of July or early part of August in 1882 or 1883, on the brick wall of the northeast side of the house, under a veranda. After that, they came each summer at about the same time upon the veranda, when the annoyance of their humming [probably in slow flight] would compel the family to leave their seats and find shelter within doors during the middle of the day. This would continue for about three weeks, when they would disappear as suddenly as they came. * Occasionally one would be seen within doors during the winter months.

Observed within doors.—Three years ago, in February, "swarms" of the fly were discovered in the north-east corner room of the first floor (the house is a double one, steam-heated, and the occupied rooms are mainly on the south side). Since then they have increased in number each year, and at their last coming, they have been exceedingly numerous, and have "swarmed on the windows all winter." With the exception of stray individuals they are confined to this one apartment.

In the sleeping rooms, a few — three or four — were occasionally found concealed beneath pillows, stand-covers, etc. When routed out from their retreats, they would depart with an "angry buzz."

Not controllable by Pyrethrum powder.—Attempt was made to destroy them with pyrethrum. All that were seen could be killed by this means, but the following day they would be found as numerous as before, while the source of the new-comers could not be ascertained. It was thought that they were hidden in the wall between the brick and the lath-and-plaster.

New quarters.—The past winter, the front vestibule had been for the first time infested with them, and during the spring, they were observed on a veranda on the second floor, over the porte-cochère. When the nights were cold, those seen on the outside of the house, found shelter between the window frames and the brick: those in the inside were observed creeping into the openings in the frames in which the window-cords ran.

Some annoying habits.—Except by their innumerable presence, at the time of their advent and departure, they were not seriously annoying to the person. The servants of the house declared that they were bitten or stung by them, but this must have been wholly imaginary. They would often alight on the hands and face, over which they would creep unpleasantly, and at times become entangled in the hair, when their peculiar "buzz" would be given. Their

wings were seldom used except when they were disturbed. A light introduced in a warm room arouses them at first, but after investigating it, they show a disposition to hide away.

Three companies of the flies.—For the last two seasons, two companies of the flies have been observed. The last comers took possession of the northwest end of the veranda and kept entirely separate from those on the northeast end. The veranda is forty feet in length, and between the two there was a stretch of brick wall of ten or twelve feet in extent, upon which a few scattering individuals only could be seen. The hose was occasionally turned upon the wall to drive them away, but as soon as it was free from drip, they returned again, and each company to its own quarters. The present summer, in early September, a third company made its appearance and swarmed on the front porch which faces the east and receives the sunshine nearly the entire day.

No other house visited.—The flies, so far as could be learned, were not found in any other house at Ausable Forks, nor in any of the other buildings upon the same grounds. Not a single one had been seen in either the conservatory or grapery. A notice of the fly and its interesting peculiarities was published in the county papers, with the request for notification if it had been observed elsewhere in the vicinity, but no response was received.

Arrival and departure.—The flies have not been observed either in their approach to the house or in their departure from it, and it is, therefore, suspected that their flights are made during the night or under cover of darkness. An advance guard seems to signalize the coming of the main body. Some morning, in the latter part of August, a few are to be seen on the wall or screens, when the announcement is made by some member of the family — “those horrid flies are coming again!” Perhaps a week thereafter, or the first hot day following, upon going out after breakfast, the *Chloropiscas* are found in such force, that the veranda is surrendered to them. They continue to abound on the veranda for about two weeks longer, when they begin to show a rapid diminution in number, through having crept into crevices and holes for their winter retreat. In a short time, all have disappeared. This year, on the twentieth of September, none were to be seen.

When the time of their departure approaches, during the month of April, they are to be seen buzzing actively about, both inside and outside of the house. The window panes, especially, abound with them on both sides. This is a favorable time to apply pyrethrum to them,

and hosts are killed in this manner.* By this means and by unobserved flight, their number continues to decrease toward the latter part of the month, and by the first of May, the last of the invaders has disappeared.

Interesting Features in *Chloropisca*.

In the above recital, several points of interest in the history and economy of the fly may be noticed, the chief of which are these: Leaving its food-plant each season in the month of August (heat of summer), and speedily taking possession of quarters where it is to pass the autumn and winter in inactivity and hibernation; its occupancy each year of the same room in a house on its north or northerly side; its awakening into activity in early spring and appearance in myriads; its gathering on the outer wall of the house and disappearance therefrom during the month of April; its flight to its unknown food-plant; and lastly, its occurrence in so few localities. How mysterious the instinct, or the principle of heredity that can guide each year the new brood upon their emerging from the plants within which they were developed, to the particular house and to the identical room which their parents had occupied for their hibernation. This, without parental guidance or direction, for as throughout the insect world, with few exceptions, the parents die before their offspring come into existence,† so in this instance, the *Chloropisca* dies soon after it has done all that it can do for its progeny in depositing its eggs upon the plants which will nourish and carry them to maturity.

Where Does *Chloropisca* Breed?

In the hope that some clue to the source of the *Chloropisca* visitations and to its selection of hibernating quarters might be obtained, request was made of Mrs. Graves for some account of her house, and its immediate surroundings. From her satisfactory reply, we extract the following:

The house is brick, three stories and an attic. It faces nearly east, is on a corner lot, 140 feet from the street in front, and 120 feet from the street on the north side. The lot, all of which is in lawn, except a plot of about a hundred square feet reserved for flowers, is 200 feet on the east side and 280 feet deep on the north side: then comes the flower garden, and back of that again more grass, old orchard, and small fruits, ending at the foot of a steep hill covered on the north side from street to top with a dense growth of pine trees, with a few

* Mrs. Graves had swept up and burned over a half pint of the flies in the second week of April.

† Exceptions are found in the ants, bees, and termites, and according to Kirby and Spence, in certain species among the *Sphecidae*, *Teuthredinidae*, *Scolytidae*, *Pentatomidae*, and *Forficulidae*.

birch, beech, locust, and hemlock. The stables, hen-house, and vegetable gardens are on the opposite side of the street on the north.

At Franklin, N. H., where the flies occurred, perhaps, in greater abundance than at Ausable Forks (see Fourth Report), the infested dwelling-house of Mr. Daniell "was surrounded by a broad lawn, and in front was fine green grass for 200 feet or more. Across the road was a hill arising to a height, perhaps, of a hundred feet, extending for an eighth of a mile, and covered with a growth of oak, pine and locust trees."

A comparison of the surroundings of the two dwellings show a striking resemblance, in which the feature in common, of an extended and encircling lawn, is suggestive: That of a neighboring eminence clothed with forest trees, among which are the pine and locust, is interesting, but would hardly need consideration in this connection. No grain fields, in which the fly has hitherto been thought to breed, are in the vicinity of either; at Franklin, "but little grain is grown within many miles;" at Ausable Forks, "no farms are within three miles."

The Fly Probably Breeds in Grass.

When informed under date of August twenty-seventh that the flies had made their appearance the day before, I was unable to visit Ausable Forks for the investigation which I had purposed to make at this time. Believing that they would be found coming out of the grasses of the lawn, and availing myself of the generous offer of Mrs. Graves to give me any assistance in her power, I wrote requesting her to cover patches of the lawn in different portions of it, with some thin muslin weighted down at the borders, that it might catch and hold any flies that might emerge.

The first attempts with thin muslin and lace were unsuccessful, as they allowed all of the small insects to escape before they could be identified. A second experiment with thicker muslin, secured a number of small flies, but *Chloropisca* was not positively identified. Later, under date of September 2d, Mrs. Graves wrote: "I went out again this morning, and after stirring up the grass with my hands, I kept perfectly still for the cloud of flying things to settle. I felt like shouting *Eureka!* when I saw *Chloropisca* in numbers on my dress and hands. Those that settled on the chamois gloves that I had on, gave me the opportunity of making sure of their identity. Of course, I can not say from this that the pest is *in* the grass, but it certainly is on the grass abundantly."

On receipt of the above, the further suggestion was made, to ensure, if possible, beyond all question, the source of the flies, that a

number of tight glass-covered boxes of as large a size as could be conveniently obtained, be distributed over the lawn, and set in *close contact* at the bottom with the soil, after driving away whatever of insect life might have previously settled on the grass. Arrangements for so doing were made, but heavy rains and cold weather ensued, and continued until too late to give any success.

Do Both Sexes Hibernate?

The concluding line appended to Baron Osten Sacken's description of this species (4th Report, page 71), which reads: "I have about thirty unpinned specimens before me; they seem to be all females," suggests the possibility that, as in some other of the orders, so in this species, it is only the female that lives through the winter. The above specimens, which had been sent by me to Baron Osten Sacken, were selected indiscriminately from a large number that had been taken in spring.

A necessarily hurried examination of a few of a small sending from Ausable Forks this summer, showed no distinguishable sexual features, nor were eggs found present in those that were opened. The search for them, however, was not of sufficient thoroughness to give assurance of their absence at the time.

Inquiring of my correspondent if any observations made showed the presence of the two sexes, answer was returned that in looking through the window pane as the flies were resting on its opposite side, a marked difference in shape was noticeable. Some were slim, and longer in the body than others, while in some the body was nearly round, rather short, and the end of the abdomen very much distended and nearly white.

The above described conspicuous difference in the shape of the abdomen, seen under the most favorable circumstances possible, seems to indicate, without much doubt, the presence of both sexes.

General Features of the Fly.

It would be strange indeed if other localities for this insect were not discovered. It should be easily recognized from its peculiar habits, as given—unlike those of any other fly known, and from the detailed accompanying drawings. Characteristic features by which it may also be known, are, its small size, only about one-tenth of an inch long; a somewhat flattened head, broader than the thorax; the thorax marked by three black stripes, of which the two outer ones are narrower and elongate wedge-shaped; two black triangular spots beneath, between the middle pair of legs; a dark brown abdo-

men, the segments of which are yellowish on their hind margin; the balancers or halteres with a yellow-white knob; the wings iridescent and considerably longer than the body.

In the accompanying Figure 7 the following enlargements of parts of the fly are shown: *a*, the wing;* *b*, head from in front; *c*, halter from below; *d*, halter from outside;† *e*, ocelli from above; *f*, ocelli from behind; *g*, a middle leg; *h*, side view of the fly; *i*, antenna, side view; *j*, antenna, front view; *k*, antenna bristle.

Its Reappearance at Franklin, N. H., in 1890.

Mrs. W. F. Daniell reports, under date of May 12th, a great diminution in its numbers the present year, as the result, no doubt, of the efforts made to rid themselves of the pest, in their spring appearance in 1887, 1888, and 1889, by the persistent use of pyrethrum freely applied with a powder-bellows. In addition to this, hot water was also thrown into the cracks and crevices about the windows and piazza where they had entered for hibernation, or for shelter during the cold days of spring.

They came from their retreats with their usual regularity this year about the first of April, and in their accustomed places, in the front rooms of the second story on the north side of the house and around the front door; but they were promptly met with pyrethrum, which killed all that were seen, and a second application was not required.

Reappearance at Alfred Center, N. Y.

Dr. H. C. Coon, of the Alfred University, in reply to an inquiry made, writing under date of November 15, 1889, stated that the flies had not been observed on the windows that they had previously occupied, but that they had been found on some papers over canned fruit in the cellar, near a north window, but in far less abundance than in preceding years. These were destroyed with pyrethrum powder. They were not observed during the following month of April.

The unusual locality given above for the fly, and its association with canned fruits, leads us to question whether examples of the pickled-fruit fly, *Drosophila ampelophila* Loew, might not have been mistaken for the *Chloropisca*, as the two are of about the same size and form.

* In the description of the wing of the fly, in the *Fourth Report on the Insects of New York*, the first vein was inadvertently referred to as the auxillary vein. In *Chloropisca* the auxillary vein is wanting—it being coalescent with the first.

† The halteres are beautiful microscopic objects, being covered with a pubescence of very fine white hairs, giving them the appearance of velvet—not representable in a figure.

Phytomyza chrysanthemi n. sp. Kowarz.*The Chrysanthemum Fly.*

(Ord. DIPTERA: Fam. PHYTOMYZIDÆ.)

Phytomyza lateralis. LINTNER: 4th Rept. Ins. N. Y., 1888, pp. 73-79, figs. 31, 32.Not *Phytomyza lateralis* of FALLÉN, MEIGEN, CURTIS, et al.*Phytomyza affinis*. FALCONER: in Amer. Florist, ii, 1887, p. 297.*Phytomyza chrysanthemi* KOWARZ MS. JACK: in Garden and Forest, iii, 1890, p. 440, figs. 55 f. f. g.*Phytomyza ?nigricornis*. WESTWOOD: in Gardeners' Chronicle, May 12, 1883, p. 593.

A somewhat extended notice of the destructive leaf-miner of Chrysanthemums, Eupatoriums, Cinerarias, etc., the injurious character of which has drawn considerable attention to it during recent years, was given in the *Fourth Report on the Insects of New York*, 1888, under the name of the Marguerite Fly — *Phytomyza lateralis* Fallén, it having been identified with the European species of that name by Baron Osten Sacken, to whom examples had been sent.

The Marguerite Fly not *Phytomyza lateralis*.

Subsequently, other examples of a *Phytomyza* found mining Chrysanthemums and other plants in the vicinity of Boston by Mr. J. G. Jack, and believed by him to be the *P. nigricornis* of Macquart, were submitted to Baron Osten Sacken for his determination. Early in the present year, Baron Osten Sacken informed me of the sending and reception of the above, and that their examination showed them to be, in all probability, of the same species received from me a few years ago, and which he had identified for me as *Phytomyza lateralis* Fallén. He further stated: "I am very sorry to acknowledge that I must have misled you in this case by a wrong determination. I do not remember now under what circumstances I committed that blunder and what prevented me from sending the specimens to Kowarz. Both species are very much alike, and the Entomologist Boie committed the same mistake (see Schiner, Fauna, ii, p. 316, foot-note). But I should have noticed that the one was bred from the heads of *Compositæ* and the other from the leaves. No wonder that I found some of the statements of Curtis misleading."

A wrong determination by the distinguished European dipterist is of so rare occurrence that, without awaiting his permission, we publish the above explanation, relying upon his well-known readiness to acknowledge and correct any error accidentally made.

It Proves to be an Undescribed Species.

The examples from Mr. Jack were submitted by Baron Osten Sacken to Mr. Kowarz,* who returned answer that they are most closely allied to *Phytomyza affinis* Fallén (non Meig. or Macq.), and must be considered as a new species. In compliance with requests made, Mr. Kowarz prepared a description of the fly, of which Baron Osten Sacken has made the following translation, and kindly sent copies of it to Mr. Jack and myself. With Mr. Jack's permission, it is herewith given:†

Its Description as *Phytomyza Chrysanthemi*.

Phytomyza Chrysanthemi n. sp. *Ph. affinis* Fall. simillima, setulis acrostichalibus in dorso thoracis vix ullis ♂ ♀, et terebra distincte brevior (♀) diversa. Fronte et epistomate flavis, antennis totis nigris, thorace cum scutello cinereis, aut unicoloribus, aut lineola pallida ante alas in thoracis lateribus parum perspicua, pedibus nigris, geniculis tantum pallidis, abdomine nigro, margine postico segmentorum anteriorum angustissime, segmenti ultimi latiore flavo.—Long. corp. 2 mm.

This species is strikingly like *P. affinis* Fall., and differs from it only in the absence of the acrostichal bristlets (at least on the front part of the thoracic dorsum), and in the shorter ovipositor.

Front and face yellow, occiput gray, antennæ altogether black, sutorial flaps of the proboscis yellow, tip of the palpi generally dark, oral bristles distinct, genæ narrow, hardly equal to one-third of the height of the eye. Thorax and scutellum uniformly gray, sometimes the former with a pale-yellow lateral stripe in front of the root of the wings; thoracic dorsum usually with four pairs of dorsal macrochetæ, but without the intermediate acrostichal bristlets;‡ seldom a few in the vicinity of the scutellum; scutellum with four macrochetæ on the edge. Wings almost hyaline; veins blackish, yellowish near the root; the costal vein reaches the tip of the third vein only, which tip is rather far distant from the tip of the wing; the first, second, and third veins are distinct, the other longitudinal veins are thin, especially the fourth, which ends in the tip of the wing; the sixth vein is incomplete; the posterior crossvein is wanting; tegulæ and halteres pale yellow. Legs black, only the knees pale-yellow; sometimes also the trochanters of the forelegs yellow. Abdomen black, but little shining, the ventral sides more or less distinctly pale-yellow; the posterior edge of the anterior segments with an exceedingly narrow pale-yellow margin; on the last segment this margin is more distinct. Genitals black, those of the male of moderate size; the ovipositor of the female hardly as long as the last abdominal segment. Twenty specimens.

* "Mr. Ferdinand Kowarz, in Franzensbad, Bohemia, I consider as the entomologist who, at present, possesses the most extensive knowledge and experience of European Diptera, especially so far as the discrimination of species is concerned."—(Baron Osten Sacken, in *Insect Life*, ii, 1889, p. 191.)

† Mr. Kowarz in referring, *in lil.*, to his observations on this insect, asks that reference may be made to the descriptions of *Phytomyza diminuta* Wlk. and *P. solita* Wlk., in the *Transactions of the (London) Entomological Society*, New Series, iv, p. 232, v, p. 232.

‡ [May also be called: the inner row of the dorso-central bristles.—O. S.]

Operations: and Figures of the Insect.

Mr. Jack has kindly given me permission to use the figures illustrating the insect which accompanied a brief notice of it in a late number of the *Garden and Forest* (*loc. cit.*). The figure of the fly in my Fourth Report was not from nature but from Curtis' *Phytomyza lateralis*, with which ours had been pronounced identical.



FIG. 8.—The Chrysanthemum fly, *PHYTOMYZA CHRYSANTHEMI*, with its larva, and its mines in a chrysanthemum leaf.

Mr. Jack has also informed me that the insect had been troublesome in the vicinity of Boston during the past three or four years, but had only come under his observation about a year ago. It had

been found there, as a miner in the leaves of *Chrysanthemums*, *Eupatoriums* and *Cinerarias* in greenhouses. The mines are irregular, and are often so abundant that the upper and lower epidermis of the leaf alone remain, and these, of course, soon shrivel and dry.

Differences Shown in the Mines.

The leaf figured above is that of the large Japanese *Chrysanthemum*, in which the operations of the larva are rather rare. Upon comparing the figure with the leaf represented in my Fourth Report, a great difference will be seen in the direction of the mines in the two. In the latter — in the large number of the leaves sent me, in every one the mine was almost wholly *confined to the margin*, following closely each division and tooth of the leaf, and *in no instance crossing itself*; while in that figured by Mr. Jack its course is quite irregular, tortuous, *frequently crossing*, and *only in two places touching the margin*, as if by accident. This great variance would seem to be quite in excess of what might be expected from the dissimilarity — marked as it is — in the size and shape of the leaves of the two *chrysanthemums*.

Do the Differing Mines Indicate Distinct Species?

A difference so marked suggested the possibility that the flies submitted to Mr. Kowarz may not have been identical with those that had been placed in Baron Osten Sacken's hands. It did not appear that there had been direct comparison of the two lots of specimens, nor had an exchange been made between Mr. Jack and myself. To set the question at rest, a number of those reared by me in 1887 from the Long Island larvæ, was sent this autumn to Mr. Kowarz, with the request that he would compare them with those in his possession received from Mr. Jack.

Shown by Comparison to be Identical.

In a letter promptly returned the undoubted identity of the two was declared: the last sending was *Ph. chrysanthemi* in litt. In addition thereto, Mr. Kowarz has kindly made comparison of the species with *Ph. affinis* and with *Ph. lateralis*, which we gladly transcribe as of interest and value to the student.

Compared with Other Species.

This species is the nearest of all to *Ph. affinis* Fall., Zett., Schin. It is very similar, but is distinguishable from this by the lack of the acrostichal bristlets, and by the relatively shorter and weaker ovipositor of the female: unfortunately I could not compare it with the male *affinis*. *Ph. chrysanthemi* has sometimes a row of acrostichal

bristlets, but always in so insignificant number that they could almost be left out of consideration in comparison with *P. affinis*.

Ph. chrysanthemi is certainly not identical with *Ph. lateralis* Fall., Zett., Schin., which, on account of the venation, Haliday has placed in a distinct genus — *Napomyza*. It appears also, extraordinarily like that in color and size, but lacks the posterior transverse vein. *N. lateralis* lives in the base of the flowers of a few *Compositæ*, while *Ph. affinis* and *Ph. chrysanthemi* are true leaf-miners. So far as known to me, *Ph. affinis* confines itself to the leaves of a few *Ranunculaceæ*, while *Ph. chrysanthemi* mines in the leaves of *Compositæ*.

I have not identified *Ph. chrysanthemi* with *Ph. affinis*, because I believe that from the absence of the bristlets and from the features of the ovipositor, the claim of the former to be a distinct species could be established.

The illustration in your Report for 1887, copied from Curtis' *British Entomology*, p. 393, is the true *Napomyza lateralis* Fallén.

It would be quite interesting to learn to what *Phytomyza* the one belongs which burrows in the leaves of *Aquilegia*, as figured on page 79 of your Report; perhaps it is the *Ph. affinis* Fall.

Remedy for the Insect.

In the former notice of this insect (4th Rept. Ins., N. Y., p. 76), it was recognized as a pest not to be controlled by ordinary remedies or preventives, and it was, therefore, recommended that, until some other more successful method could be found, the plants should be examined at brief intervals after the first recognition of the attack, and every infested leaf picked off and burned.

This method seems to have been quite effective in the greenhouses of Mr. Dana, at Dosoris, L. I., where the insect was first noticed, as appears from a note of Mr. W. Falconer, written January 31, 1888, stating: "Although the cool months of the year — October to May — are the favorite times for the appearance of the larvæ, our greenhouses at the present time are almost free from them; and this, not from any remedy employed, but from watching diligently for the first indication of their operations, and plucking and destroying every infested leaf."

Dynastes Tityus (Linn.).

The Spotted Horn-bug, or the Rhinoceros Beetle.

(Ord. COLEOPTERA: Fam. SCARABÆIDÆ.)

PAL. DE BEAUVOIS: Ins. recueil. en. Afr. et Amer., 1805, p. 138 (as "*Scarabæus Tityus*").

LATREILLE: Encyc. Method. Hist. Nat. Entomol., x, 1825, p. 347 (mention), pl. 137, f. 7 (as *Scarabæus Tityus*).

WALSH-RILEY: in Amer. Entomol., i, 1869, p. 168 (identified from Miss.).

RILEY: in Amer. Entomol.-Bot., ii, 1870, p. 276 (features).

SMITH: in Ent. Amer., ii, 1886, p. 163; in Proc. Ent. Soc. Wash., i, p. 54; in Pop. Sci. Monthly, xxx, 1887, pp. 409, 410 (a public nuisance).

LUGGER: in Ent. Amer., ii, 1886, p. 163 (fondness for the ash); in Proc. Ent. Soc. Wash., ii, 1888, p. 54 (food-plant).

SCHWARZ: in Proc. Ent. Soc. Wash., i, 1886, p. 55 (odor of pupa).

HOWARD: in Proc. Ent. Soc. Wash., i, 1886, p. 56 (offensive in Raleigh, N. C.).

HAMILTON: in Canad. Entomol., xviii, 1886, p. 112 (change in color and noises made).

LINTNER: 5th Rept. Ins. N. Y., 1889, pp. 227-231, figs. 26, 27 (general account).

LEAVELL: in Insect Life, iii, 1891, p. 395 (dug up under a woodshed in Va.); ib., RILEY-HOWARD (identification of the same and breeding habit).

(The above are additional to the references given in the 5th Rept. Ins. N. Y.)

In the notice of this insect in the *Fifth Report on the Insects of New York*, incidental reference only is made to its larva. My attention having recently been drawn to some of the peculiar habits of the beetle, it became desirable to learn something of its early life, but nothing descriptive of its larva or pupa could be found in our publications.



FIG. 9.—Side view of the Rhinoceros beetle.

On inquiry of Dr.

Riley if he could assist me in the matter, he has most kindly given me for publication the careful and extended descriptions which follow, of these two stages, taken from the MS. notes on Undescribed Coleopterous Larvæ, upon which, in connection with Mr. E. A. Schwarz, he has been for a long time engaged. Figures illustrative thereof were also made, to accompany the descriptions, electrotypes from which have been furnished me, with permission for their use — for which privilege grateful acknowledgment is rendered.

Description of the Larva.

Length, 13 centimetres. Of the normal Lamellicorn form, enlarging but little posteriorly. Color, dirty yellowish-white, head reddish-brown, mandibles piceous or black, other mouth-parts and legs pale reddish-brown. Head slightly wider than long, convex above, coarsely rugose-punctate over the whole surface, the punctations often umbilicate, the narrow interstices shining; a few long setæ are scattered over the surface; epistomatal line almost entirely obliterated and difficult to trace, space inclosed by it distinctly wider than high; clypeus about four times wider than long, trapezoidal, coarsely, not densely punctate, slightly convex longitudinally; no trace of ocelli; antennæ shorter than head, consisting of four joints and a large, trans-

verse basal tubercle; joints 1-3 clavate; joint 1 about twice as long as its width at tip; joint 2 one-fourth longer than joint 1; joint 3 as long as joint 1, slightly and obliquely produced at its lower apical

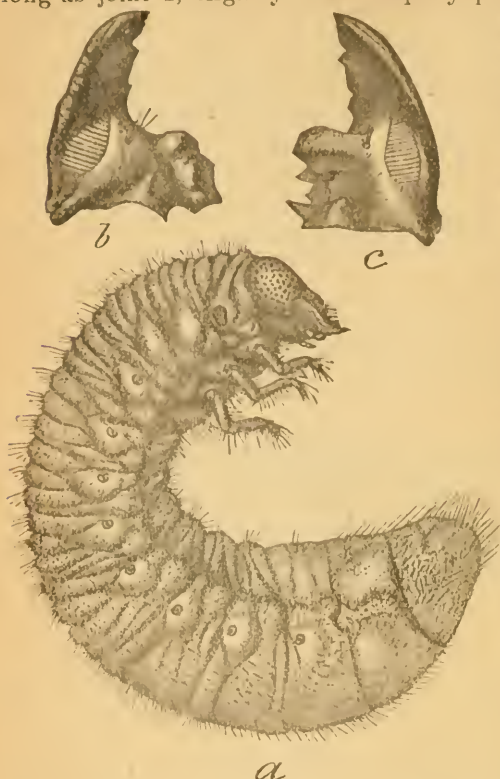


FIG. 10.—Larva of the Rhinoceros beetle, *DYNASTES TITIUS*, in natural size, with its mandibles enlarged.

angle; joint 4 somewhat shorter than joint 3, acuminate at tip; labrum a little longer than the clypeus, slightly narrowing anteriorly, sides rounded, anterior margin truncate and armed with long stiff bristles; upper surface rugosely punctate. Mandibles nearly as long as the width of the clypeus, outer surface near base coarsely cribrate and furnished with two longitudinal carinae, the sloping inner surface and tip smooth; edge of scissorial part with three obtuse teeth, the terminal one large and triangular, the middle one smaller but also triangular, the basal one rectangular, the three teeth as well as the manducatorial tooth larger on the left than on the right mandible; left manducatorial tooth quite prominent at the anterior edge and forming a right angle with the scissorial surface; right manducatorial tooth with its anterior edge not prominent, under surface of scissorial part opaque at tip, smooth and shining toward the base; stridulational surface about three and one-half times longer than wide at middle, the ridges becoming finer and shorter towards the apex. Lobes of maxillae connate on the under (outer) side, except that there is a shallow, smooth dividing furrow at tip; on the upper (inner) side the dividing suture is distinct throughout; both lobes are on either side covered with long yellow spines arising from little tubercles; the outer lobe terminates in a stout thorn, inner lobe at tip with three closely set triangular teeth; stridulating teeth on inner surface not placed on a distinct ridge and consisting of six larger and two or three very small and indistinct teeth; maxillary palpus decidedly longer than the outer lobe, three-jointed, first joint distinctly clavate and twice as long as its width at base, second joint as long as the first and very slightly clavate, third joint narrower but one-fifth longer than the second, subacuminate at tip. Mentum and lingua on

the under side smooth and shining, opaque and spinulose on the upper surface; palpi of the usual form.

Prothoracic joint, when viewed from the side, slightly longer than the other two thoracic joints. Dorsally the three thoracic and the first six abdominal joints are essentially alike in length and sculpture; they are triplicate in the usual manner and covered with rather sparse, small, shining tubercles, each giving rise to a stiff, moderately long, blackish spine, directed backwardly; there is also on each joint a more or less regular transverse row of long brownish setæ. The last four abdominal joints are much longer, not sulcate and much smoother; the anal joint longer but much narrower than the pre-anal, transversely convex and evenly rounded at tip, its surface is sparsely beset with irregular long setæ more densely so at tip. On its under surface and not visible from above, the terminal joint has a transverse slit which causes it to appear divided in two parts. Spiracles large, the abdominal ones regularly short-oval in outline, the break in the peritreme very narrow; prothoracic spiracle decidedly larger, more oblong and less regular in outline.

Legs stout, covered with long but rather sparse setæ; second pair thicker and slightly longer than the first; third pair again longer than the second; the claw is short, robust, and subulate at tip.

Under surface of abdomen more shining, more sparsely tubercled and less spiny than the upper surface.

The description is made from an alcoholic larva found in a rotten stump at Wilkesboro, N. C., in the month of June.

Attention is called to the fact that Dr. Eugène Dugès in describing the larva of the Mexican *Dynastes Hyllus*,* says, that the larva is distinguished from that of *Strategus julianus* only by the sculpture of the body and the form of the last abdominal joints. In the former species the abdominal joints and the two posterior thoracic joints are said to be furnished with numerous *longitudinal* folds (plis), and the terminal joint flattened above so that when viewed from above it appears to be triangular in outline. Referring to DeHaan's figure of *Dynastes hercules*,† I find the general sculpture and the form of the last abdominal segment to correspond with those of our *D. Tityus*, and as I know of no Lamellicorn larva having longitudinal folds except from contraction, I half suspect that those in Dugès' specimen were unnatural.

Description of the Pupa.

Pupa of male.—Covered with a very fine velvety pruinosity and therefore opaque. Where the pruinosity is abraded the body appears to be somewhat shining. No distinct sculpture is visible; horns on head and prothorax much thicker and stouter than in the imago, and faintly ringed transversely. Mesonotum and metanotum with a very fine faintly impressed median line. The sutures between the first six abdominal joints are deeply and suddenly depressed, the joints themselves appearing to be very short and somewhat gibbous. Base of the first joint as well as the anterior and posterior margin of the four following joints and the anterior margin of the sixth, furnished on

* *Ann. Soc. Ent. Belgique*, xxxi, 1887, p. 137.

† *Nouv. Ann. Mus. d'Hist. Nat.*, iv, 1835, pl. 11, fig. 1.

each side of the middle with two transverse, slightly impressed areas surrounded by sharply defined shining ridges. The posterior margin

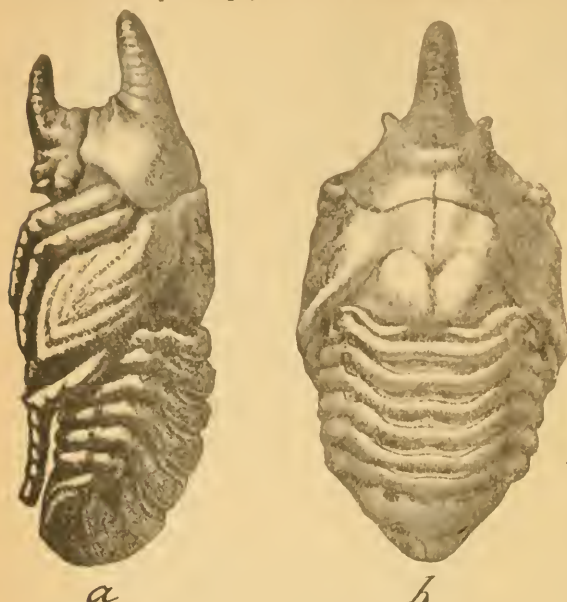


FIG. 11.—Pupa of the Rhinoceros beetle, *DYNASTES TITYUS*: *a*, side view; *b*, dorsal view. In natural size.

dorsal, very large, oblong and transversely placed; the posterior pairs of spiracles can not be seen in the specimens before me: they are probably smaller than the anterior ones.

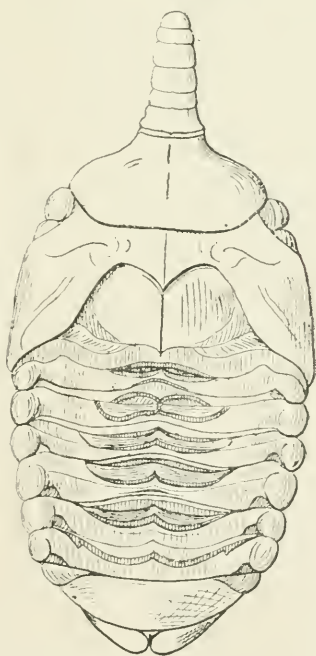
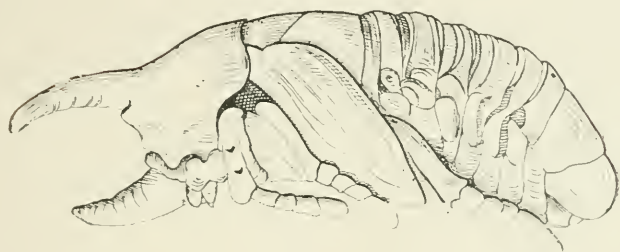
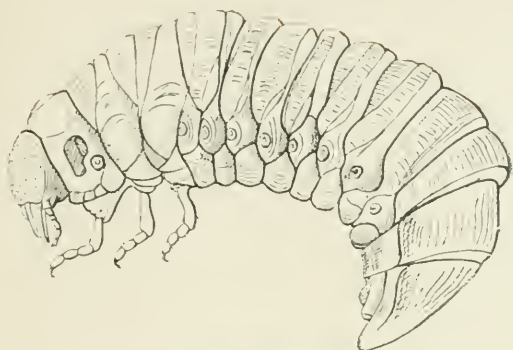
Described from two specimens, both dried up and injured.

The peculiarities of the genus in the adolescent states, as for instance, the rotten-wood feeding habit of the larva, the strong, peculiar odor of the larva and pupa lasting even after death, and the stridulation of the imago, [*] are all recorded by authors.

A Mexican Species of *Dynastes*.

In the above, Dr. Riley has referred to the description of the Mexican *Dynastes Hyllus* Chev., by Dr. Eugène Dugès, of Guanajuato, Mexico. For comparison with the early stages of *D. Tityus*, Dr. Dugès' figures of *D. Hyllus* are herewith given, copied from his notice of the species in the place above cited.

* There is no record of the stridulation of the larva having been heard. Dr. Hamilton (*loc. cit.*) has remarked of the imago: "While no stridulating organs are present, they have the power to produce a sound that may answer the same purpose, somewhat resembling that of an angry goose. The pygidium and part of the last ventral surface are very hairy, and by withdrawing the abdomen from the elytra so as to admit air and then suddenly forcing it out through the hair by a sudden extension, a noise is produced that is rather alarming to one unacquainted with their harmlessness."



12.—The larva of *DYNASTES HYLLUS*. FIGS. 13, 14, 15, the pupa of the same in lateral, ventral, and dorsal views.



The larva, Fig. 12, with others, was found within an opening in the trunk of an oak, in the midst of a mass of woody debris. One having transformed to the pupa, gave out the imago in about a month. Later, in enlarging the opening, two pupæ of males (Figs. 13, 14 and 15) were found, inclosed in a large (une énorme) cocoon formed of the detritus in which the larvæ had lived, smooth on the interior, and of a thickness not less than a centimetre.*

In the same oak, and associated with the above, were thirty or thirty-five larvæ of the closely allied *Strategus*, and several of *Mallodon angustatum*.

Feeding Habits of the Beetle.

In the notice of this insect in the *Fifth Report on the Insects of New York*, referring to its feeding habits, Mr. G. E. Murrell is quoted as stating :

When feeding on the ash, they place themselves longitudinally on a smooth limb, and, rising to the full extent of their legs, move their entire body backward and forward like a plane, using several chisel-like projections on the under side of the head for cutting — stopping the motion as soon as the alburnum is reached.

In comment upon the above, it was intimated that further information was desirable as to whether the beetle preferred the bark to the leaves, and if it consumed, harmlessly, only the outer bark, or injuriously, also the alburnum beneath.

This information has been supplied in a subsequent communication from Mr. Murrell, in which he has written as follows :

I inclose you portions of an ash limb, *planed* by the beetles, from which you can see that they feed on the alburnum, and the size of the shaving that they take at a stroke. They do not eat the leaves, but attack limbs from three inches in diameter down to the smallest twigs.

I can give no information as to habits below ground, but in the autumn the ground beneath the trees will be covered with the adult dead, and the ground perforated with holes next to the tree-trunk.†

From specimens of the wood sent, the “shavings” cut by the beetles appear to be from one and one-half inch to two inches in length. From Mr. Murrell’s statement it may be inferred that the outer bark is first planed or scraped off and rejected, exposing the alburnum or sap-

* A correspondent of Dr. Hamilton has represented these cocoons as “oblong cases about three to four inches long and three inches in diameter, composed of the rotted wood in which they were imbedded.”

† Mr. B. D. Walsh believed that such “holes around the roots of young ash trees” on Long Island, N. Y., were made by the large black Rhinoceros beetle, *Xyloryctes Satyrus* Fabr., which were found near them, the larvæ of which live underground and feed on the roots (*American Entomologist*, i, 1868, p. 60).

wood, which is then eaten. More than the tender cambium layer has been apparently removed — possibly all of the exposed alburnum, as in the pieces received, the bottom of the wound shows patches of black and dead-wood, overgrown at their margins by the new growth that had taken place since the injury was inflicted.

Another quite different habit of obtaining food has been ascribed to *Dynastes* by some writer whom we can not now refer to, nor would it, probably, authenticate the statement or give it any claim to consideration, if it could be found. The beetle is said to attach itself to a small branch by grasping it between its horns, and twirling its body round and round by a rapid movement of its wings, so tears the bark as to give it the food desired — either the inner bark or, as some suppose, the sap that flows from the laceration.

Possibly the beetles may be both bark-eaters and sap-suckers. Mr. J. Doll records* of a species of *Dynastes* observed by him, and of which he "captured over one hundred examples, some fully four inches in length," in Hell's Canon, Arizona, that "they are always found near the tips of branches, where, by means of their projecting thoracic horns, they scrape through the soft bark to cause a flow of sap, which is very sweet, and of this consists their food."†

In further remark upon the feeding habits of the beetle, Mr. Lugger may be quoted, in giving the water-ash [black ash] *Fraxinus sambucifolia* as its favorite food-plant. On the shore of eastern Maryland he had attracted the beetle by bruising ash-twigs — a friend from Mexico having informed him that in that country they were so taken (*Ent. Amer., loc. cit.*). The bruised leaves of this species of ash are well known for the peculiar odor that they give forth; Dr. Asa Gray has compared it to the scent of elder.

Variations in Color.

The different colors occasionally presented in individuals of this species, particularly in the female, has often been remarked upon. In my preceding notice of the insect it is stated: "One example in my collection has the thorax black, while in another both the thorax and the wing-covers are very dark brown. A male before me has the thorax of the normal color, while the elytra are dark brown, slightly mottled with paler brown."

Some have thought these darker colors to be the result of "greasing," but Dr. Hamilton seems to have found the proper explanation.

* *Bulletin of the Brooklyn Entomological Society*, vii, 1885, p. 121.

† This species is thought by Dr. Horn to be *Dynastes Grantii*, described by him in *Trans. Amer. Entomolog. Soc.*, iii, 1870, p. 78, as a variety of *D. Tityus*: it is so cited in the *Fifth Rept. Ins. N. Y.*, 1889, p. 227, but is now regarded as a valid species.

Of two specimens taken early in December from a cavity in a poplar in Clairborne county, Tenn., he has written :

When received, about three weeks after being taken [from their cases when they were "soft and white"], the male was assuming the greenish hue, and in three weeks more was normally colored. The female was entirely brown, and in four weeks had changed to nearly black; the black then began to fade, and in about four weeks more the beetle had taken on the greenish tint, with the usual brown maculae. No further change in color has occurred till the present, April 6th. It may be possible that the brown males and females mentioned by writers are immature individuals, as it would appear from the above that it requires from two to three months to perfect the colors.

Early Observations on the Insect in Pennsylvania.

Say, in his description of the beetle in 1824, remarks that "it is so extremely rare in Pennsylvania, that the late Rev. F. V. Melsheimer, the parent of entomology in this country and a very industrious collector, found but two individuals in eighteen years."

Dr. S. S. Rathvon, a veteran entomologist, whose name, although not now frequently quoted, should long be held in grateful remembrance for the service that he rendered to entomological science in its earlier days, and who is still living at the advanced age of nearly eighty years, at Lancaster, Pa., although withdrawn from active labors through the heavy burden of serious bodily infirmities resting upon him*—has kindly given me in a recent communication some recollections of his first acquaintance with *Dynastes Tityus* in Pennsylvania, from which I extract :

"The Rhinoceros beetle," *Dynastes Tityus*! How far back my memory runs in connection with that gigantic subject of Coleopterous realms.

The first specimen I ever saw (a female) was in the possession of the late Judge Libhart of Marietta, Pa., in 1839, and was captured near Wrightsville, York county, Pa. Twenty years later, I received a male specimen that was captured in the same county opposite Marietta, which is about three miles above Wrightsville. In the meantime I had received a male and female from Kentucky, and a male from Virginia.

In 1859 or 1860 a large willow tree was blown down by a storm, at the village of Safe-Harbor, in the county of Lancaster. The trunk, inside, was much decayed, and in it were found about twenty specimens, and a number of larvæ. I did not learn of this for a week or ten days thereafter, and was only able to secure a single pair, from a person in Lancaster city who obtained them on the spot. Perhaps half a dozen were secured and the others permitted to escape. I sub-

* Dr. Rathvon died at Lancaster, Pa., on March 19, 1891.

sequently came in possession of a female which had been captured near New Holland, about ten miles east of Lancaster. The largest specimen that I have ever seen from this state, was taken within our city limits in 1870. This one, a male, I kept alive in a wire cage for several days, but he eventually forced some of the wires apart and made his escape and was never recovered.

In 1873, in a wood about three miles northwest of Lancaster city, just where one tree had fallen across another — both much decayed — under the bark in the rotten wood, I secured three very large specimens of larvæ, which I believed to belong to *Dynastes*. Not being otherwise prepared, I put them in the outside pocket of a skeleton summer coat, filling it with the debris. When I reached home, two hours or more later, I found a hole cut through the pocket and the larvæ had escaped, nor were they to be found in the vehicle. As the skirt of the coat hung outside of the seat, they had doubtless fallen to the ground somewhere on the road. I feel pretty sure that they were not the larvæ of *Copris*, *Osmoderma*, or any species of *Lachnosterna*, nor yet *Passalus*. They were the largest Lamellicorn larvæ I had ever seen; too large, also, I think, for *Lucanus*.

Its Occurrence in New York.

In my previous notice of this insect, its occurrence in this state was inferred from Dr. Fitch having given it place in his *Third Report on the Insects of New York*, among the insects of the cherry tree. But upon referring to what he had written of it, this appears: "I have specimens of it from Pennsylvania, but know not of its ever having been found in New York."

For my first knowledge of its occurrence within our state, I am indebted to Mr. Berthold Fernow, who has informed me, that one evening in the latter part of July, 1889 — the precise date was not noted — as he was sitting by an open window, at Kingston, a large female *Dynastes* flew in and alighted on his table. It was captured, and a few minutes thereafter, a male entered through the window, evidently drawn by the presence of the female, of which it may have been in pursuit.

There is no record of *Dynastes Tityus* being attracted to light and entering houses, but Mr. Lugger has mentioned as a singular habit of the beetle, that "the males had a fashion of flying into the chimneys of cabins. He had found remains of as many as fifty in a single deserted cabin." Where this occurred, was not stated.

Query: What can be the attraction of chimneys to the *Dynastes*? Possibly it is the same with that which sometimes, according to "Walsh and Riley," leads the larvæ of the Hellgrammite fly, *Corydalis cornutus* (the *Dobson*, of fisherman) to leave the water and the bank of the stream and wander some distance away that it may "crawl up the

wall and on the roof of a low one story frame building [clapboarded?] and then [after climbing the chimney] tumble accidentally [?] down the chimney, to the great dismay of the good woman of the house!" (*American Entomologist*, i, 1869, p. 62.)

Bruchus obsoletus Say.

The Bean-Weevil.

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

SAY: Descriptions of North American Curculionides, July, 1831, p. 2 (orig. descrip.); the same, in Comp. Writ., Lec. Edit., 1883, i, p. 261; as *B. obtectus*, pp. 1 and 259 of same publications.

FITCH: in Trans. Soc. Encour. Domes. Ind., 1861, p. 62 (as *B. fabæ*).

RATHVON: in Amer. Entomol., ii, 1870, p. 118 (occur. in Penn., discuss. of name, remedy).

RILEY: in Amer. Entomol., ii, 1870, p. 119 (compared with other sp.), p. 125 (ident. from West Farms, N. Y.), p. 182 (do. from Ill.), p. 307 (do. from N. J.), p. 374 (do. from Pa.); in Trans. Kans. St. Hort. Soc. for 1872, 1873, p. 110 (in Kansas).

ANGUS: in Amer. Entomol., ii, 1870, p. 125 (abundance in West Farms).

FULLER: in Amer. Entomol., ii, 1870, p. 302 (abundance in stored beans).

PACKARD: Inj. Ins. New and Little Known, 1870, pp. 19-21 (habits and descrip. of diff. stages, as *B. granaria*); 1st Rept. Ins. Mass., 1871, p. 22 (= *B. varicornis* Lec. MS.); in 9th Rept. U. S. Geolog.-Geograph. Surv. Terr., 1877, p. 767 (as *B. fabæ*); Guide Stud. Ins., 1878, pp. 484, 711, pl. 14, figs. 8, 8a (as *B. varicornis*); Entomol. for Beginners, 1888, p. 104 (mention as *B. obsoletus*), p. 207 (mention of *B. fabæ* Riley).

GLOVER: in Rept. Commis. Agricul. for 1870, 1871, p. 72; id. for 1871, 1872, p. 375 (brief mention, as *B. fabæ*).

RILEY: as *B. fabæ*: 3d Rept. Ins. Mo., 1871, pp. 52-56, f. 19 (distrib., habits, injuries, description, etc.); in Trans. Acad. Sci. St. Louis, iii, 1877, p. 220 (imported); in N. Y. Tribune, Feb. 20, 1878 (habits and distrib.); Ind.-Supp. Repts. Ins. Mo., 1881, pp. 67-71 (descrip. and comp. with "*B. obsoletus*" et al.); in Rural N. Yorker, Dec. 9, 1882, xli, p. 835 (habits and preventives).

HORN: in Trans. Amer. Ent. Soc., iv, 1873, p. 337 (description, and *B. fabæ* a synonym).

CROTCH: Check List Coleop. Amer., 1873, p. 93, No. 5498 (= *fabæ*).

LE BARON: 4th Ann. Rept. Ins. Ill., 1874, p. 129 (brief reference).

LECONTE-HORN-LEIDY: in Proc. Acad. Nat. Sci. Phil., 1876, p. 270; in Rept. Ent. Soc. Ont. for 1876, 1877, p. 22 (from various countries).

THOMAS: 6th Rept. Ins. Ill. [1877], p. 128 (brief description).

POPEOE: in Trans. Kans. Acad. Sci., v, 1877, p. 34 (local in Kansas); in Industrialist, Feb. 8, 1890 (injuries in K. and remedies); in 2d Ann. Rept. Kans. Agricul. Exper. St. for 1889, 1890, pp. 206-210, pl. 9, figs. 1, 2, 3, 4 (history, bibliography, operations, description).

- HARRINGTON: in 7th Rept. Ent. Soc. Ont. for 1880, 1881, p. 50, f. 33 (mention).
 DWIGHT: in Trans. Vass. Bros. Inst., i, 1881, pp. 80-87 (appearance at Poughkeepsie).
 LINTNER: in Count. Gent., xlv, 1881, p. 7 (distribution and remedies, as *B. fabæ*), p. 795 (general account, as *B. obsoletus*); id., xlviii, 1883, p. 317 (remedies, as *B. fabæ*); 2d Rept. Ins. N. Y., 1885, p. 49 (distrib. and remedies); in New Eng. Homestead, Dec. 21, 1889, p. 425 (remedies); 6th Rept. Ins. N. Y. 1890, pp. 178, 185 (ref. to notices); in Count. Gent. lv., 1890, p. 898 (life-history, breeds in old beans, remedy).
 LAZENBY: in 1st Ann. Rept. O. Agricul. Exper. St., 1883, p. 80 (mention, as *B. fabæ*).
 DIMMOCK: in Cassino's Stand. Nat. Hist., ii, 1884, p. 335 (brief reference).
 DORAN: Rept. Econom. Ent. Tennessee, 1886, pp. 204-206 (injuries in Tennessee, etc).
 BETHUNE: in 17th Rept. Ent. Soc. Ont., 1887, p. 60, f. 36 (remedies).
 RILEY-HOWARD: in Insect Life, i, 1889, p. 316 (introduction in California).
 WEED: in 7th Ann. Rept. O. Agricul. Exper. St. for 1888, 1889, p. 163, f. 7 (heat for killing); in id., for 1889, 1890, p. lii (continuation of injuries).
 HAMILTON: in Trans. Amer. Ent. Soc., xvi, 1889, p. 150 (distribution, etc.); in Psyche, vi, 1891, p. 148 (on a synonym).
 FAUVEL: in Revue d'Entomologie, viii, 1889, p. 153 (gives synonymy as follows; *B. obtectus* Say, *obsoletus* Say, *fabæ* Riley, *irresectus* Fahr., *pallidipes* Fahr., *subellipticus* Woll., *Breweri* Crotch.).
 JANSON: in Ormerod's Injur. Farm-Fruit Ins. So. Africa, 1889, pp. 22-28, f. 13 (in So. Africa, descrip. and remedies as *B. ? subarmatus*).
 COCKERELL: in Insect Life, ii, 1890, p. 332 (in Colorado).
 COOK: in Grange Visitor [Paw Paw, Mich.] for Oct. 1, 1890, p. 1, c. 4-5 (brief life-history).
 REITTER: in Cat. Coleop. Eur., Cauc., Armen. Ross., 1891, p. 332 (as *Mylabris irresecta* Fahr.).

A Comparatively Recent Insect Pest.

The bean-weevil, *Bruchus obsoletus* has been added to our list of insect pests within a comparatively recent time. No mention is made of it in the published writings of Dr. Harris or Dr. Fitch, although Dr. Harris deemed it desirable to devote four pages of his *Treatise on the Insects of New England* to its intimate associate (of later days) in the garden and field — *Bruchus pisorum* (Linn.).* In earlier years, like many of the insect pests of the agriculturist, it undoubtedly fed on some one or more of the many wild plants of the pulse or bean family. Its first recognition and description by Thomas Say, nearly sixty years ago, was from western specimens obtained by him from the seeds of an *Astragalus* — a genus of leguminous plants. For nearly thirty years following, it does not appear to have assumed any economic importance.

* *Curculio pisorum* Linnaeus. *Amoen. Acad.*, tom. 3, 1756, p. 347.

Probably an Introduced Insect.

It has for a long time been accepted as a native species, but from its having been found in recent years, in importations from other countries, and also from some late synonymical references of it by European authors, as will be noticed hereafter, it seems quite probable that it has been introduced in the United States through commerce from the Old World, and possibly from Asia.

Known Under Two Names.

The differences separating some of the species of the *Bruchidæ* are very slight as would naturally be expected in so large a family (about four hundred species are known), and all possessing the habit in common of feeding on, and undergoing their transformations within, the seeds of plants, mainly those of the *Leguminosæ*.*

To this close resemblance it is owing that the species under present consideration appears in our entomological literature under the two names of *Bruchus obsoletus* and *Bruchus fabæ* — Prof. Riley having found in some examples received from Pennsylvania, in 1870, features which seemed to him to warrant the designation of another species, and accordingly gave them minute description under the latter name. Dr. Horn, our conceded authority in the Coleoptera, not being able to recognize in them differences of specific value, has referred them to *B. obsoletus*. In a late Washington publication, edited by Dr. Riley,† we find the form referred to as *Bruchus obsoletus* var. *fabæ* Riley, and this will perhaps be accepted as a proper settlement of a disputed name.

Earliest Attack on Cultivated Beans.

The earliest notice of its operating upon cultivated beans, is that given by Dr. Fitch, in 1860, he having received a small parcel of infested beans from Providence, R. I. Next in order, Mr. James Angus, of West Farms, N. Y., writing in 1869, *loc. cit. sup.*, states that he had seen five or six years previous, a heap of beans lying on a barn floor, nearly all of which were infested with the beetle — one-half, at least, quite badly.‡ Some of the beans contained as many as fourteen of the larvæ or grubs.

Mr. S. S. Rathvon, of Lancaster, Pa., writing the same year (1869), reports the beetle as having been discovered infesting ripe seed beans in Lancaster, within the preceding five years.

* They infest the plants of this order in the tropics. Kirby and Spence state: "In tropical climates the seeds of almost every pod-bearing plant, as of the genera *Gleditsia*, *Theobroma*, *Mimosa*, *Robinia*, etc., are eaten by some species of *Bruchus*." See also, J. G. Jack, in "Weevils in Leguminous Tree-seeds," in *Garden and Forest*, iv, 1891, pp. 280, 281, fig. 49.

† *Insect Life*, v, ii, 1890, p. 332.

‡ *American Entomologist*, v, ii, 1869, p. 125.

Beans infested with weevil (presumably this species) were common in the supplies furnished to the army in South Carolina, in 1863, to the extent that the soldiers were in the habit of soaking them and afterwards laying them out to dry in order to allow the beetles to escape.*

Its Rapid Spread and its Distribution.

The rapidity with which the attack of this insect spread over the country, was somewhat remarkable. The ten years following its earliest notice seems to have carried it over a large part of the United States. When Prof. Riley wrote of it in 1870, it had already become quite common in the State of New York; had appeared in several of the New England States; it was known in New Jersey, and it was distributed throughout Pennsylvania; it must also have been carried with the army into several of the Southern States. Westward, it had obtained a firm footing in Illinois in 1865; in 1869, it made its first appearance in Missouri, in a locality near St. Louis; and in 1872, it was detected in Kansas. Subsequently, it has continued its westward progress, and in 1889 we have it reported from the Pacific Coast, California, where it is believed to have been introduced during the year 1887, in some "Golden wax" beans brought into the Carpenteria valley.† In the present year, it made its appearance in Colorado (Cockerel, *loc. cit.*).

It would be strange and unaccountable if it has not yet invaded Canada, but no notice of its presence there is known to me, and upon inquiry of Mr. Fletcher, Entomologist of the Experimental Farms, he informs me that he has no knowledge of its occurrence in the Dominion, nor has Mr. Saunders.

As the beetle is of sluggish habits, and not addicted to flight, it is believed that its distribution throughout the country is mainly by means of infested beans. This is the explanation of its being so often reported to us from various portions of the United States, as a new pest of the bean, never before known in that particular locality. Its distribution would doubtless be very materially limited if all dealers would carefully examine each purchase of beans made from other places, and at once subject infested stock to proper treatment.

Its Occurrence in Other Countries.

In a Report entitled "Report on Insects Introduced by Means of the International Exhibition," made by Dr. J. L. LeConte, Dr. Geo. H.

* Riley: in *Third Report on the Insects of Missouri*, 1871, p. 52, and Fitch MS.

† *Insect Life*, v. 1, 1889, p. 316.

Horn, and Dr. Joseph Leidy, in behalf of the Committee appointed by the Academy of Natural Sciences of Philadelphia, Oct. 10th, 1876, "to investigate and report upon the introduction of new species of insects and plants through the medium of foreign exhibits at the Centennial Exhibition"—among twenty-eight species of insects mentioned (no less than eight are species of *Bruchus*—four undetermined), *Bruchus obsoletus* is named as found "in beans from various countries of both continents." As this bean-weevil had been generally accepted as a native species, it would have been of interest if the several countries in whose exhibits it was discovered had been specified, so that some intelligent opinion could have been formed as to whether it was native to any of those countries, or had, through commerce, been carried thither from our shores.

Dr. Hamilton (*loc. cit.*), in referring to this Report, says: "It was found in beans from various European countries in the Centennial Building at Philadelphia, but I have not observed the name on any European catalogue."

In Prof. Riley's Report on the "Centennial Insects," published in the *Transactions of the St. Louis Academy of Science*, the occurrence of *B. obsoletus* in beans from Jamaica, West Indies, is mentioned.

Just as this Report is about to be submitted for publication, happening to refer to the description by Mr. O. E. Janson, of the "South-African Bean-seed Beetle," which had been submitted to him by Miss Ormerod, and which he had identified, *with doubt*, as *B. subarmatus* Gyll. (see "Notes and Descriptions of a few Injurious Farm and Fruit Insects of South Africa," by Eleanor A. Ormerod, London, 1889, 116 pp.), I am struck with the close agreement of the description of the South African insect with that given by Dr. Horn, of *B. obsoletus*. In arranging the two in parallel columns *every item* in that of "*? subarmatus*" agrees *exactly* with the corresponding one of *obsoletus*, except in thoracic punctures, which in the former are given as *close* and in the latter *sparse*; also, the sizes assigned are 4 mm, as against 2.5 to 3.5 mm.

Examples of *obsoletus* will be sent to Miss Ormerod for comparison with "*? subarmatus*."

That the two will prove identical seems the more probable from the extended distribution assigned to *B. obsoletus* by M. A. Fauvel, in accordance with the synonymy of the species (*B. oblectus* given priority) recently given by him (in *loc. cit.*), and which has just been brought to my notice through Dr. Hamilton, viz.:

"Central and South America, Madeira, Canaries, Azores, Mediterra-

nean Basin, Persia, etc. Carried by commerce, it is probably cosmopolite." (See foot-note.)

General Features of the Beetle.

The bean-weevil, when found infesting, or in association with injured beans, may be recognized by the following features, many of which are in common with other members of the same family:

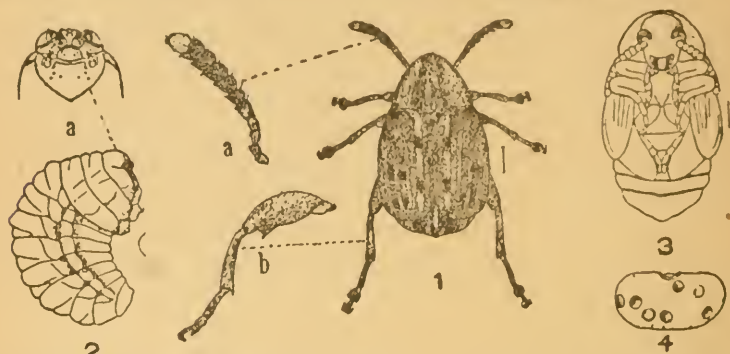


FIG. 16.—The bean-weevil, *BRUCHUS OBSOLETUS*: 1, the beetle; 1a, the antenna greatly enlarged; 1b, a hind leg enlarged to show the femoral teeth; 2, the larva; 2a, larval head enlarged to show mouth-parts; 3, the pupa; 4, a bean burrowed by the insect.

It is a hard-shelled beetle, one-tenth of an inch long, of an oval form, having its head bent downward and more or less concealed as seen from above, and prolonged in a short, squarely cut snout or beak. Its antennæ are distinctly jointed and enlarged at the tip; the first four joints and the terminal one are reddish or yellowish. The thorax and abdomen at their junction are about of equal width. The wing-covers (elytra) are marked by ten impressed and punctured lines in flattened ribs, which are clothed with a short pubescence arranged in yellowish, black, and whitish spots and lines—the white lines more distinct on the third rib or interval. The grayish tip of the abdomen extends nearly one-half the length of the wing-covers beyond them, and is faintly marked with a central whitish line. The legs are short, of a reddish color; the thighs (femora) of the hind pair are quite thick.

The above figures, for the use of which I am indebted to the courtesy of Professor Popenoe, of the Kansas State Agricultural College, should insure its recognition, and will also serve to illustrate its early stages.

NOTE.—The comparison of the two has since been made by Mr. Janson, and they are unhesitatingly pronounced identical.

In the light of our increasing knowledge of the distribution of this insect through commerce in the four quarters of the globe, there can hardly remain any reason for longer regarding it as native to the United States of America.

Compared with the much better known pea-weevil, shown in Fig. 17, *obsoletus* is not one-half so large, is more soberly colored, having less white on the wing-covers, and is without the white spot on the middle of the hinder part of the thorax and the two oval blackish spots which so conspicuously mark the exposed tip of the abdomen of *Bruchus pisorum*. In the latter the whitish hairs of the wing-covers form an oblique, interrupted, bent band behind the middle.

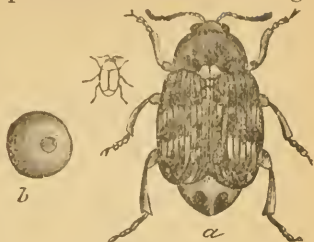


FIG. 17.—The pea-weevil, *Bruchus pisorum*, natural size and enlarged; *b*, a pea containing the weevil.

Description of the Beetle.

Say's description (*loc. cit. sup.*) of *Bruchus obsoletus* may be consulted for more positive determination. It is as follows:

Body blackish cinereous with a slight tinge of brown; antennæ not deeply serrate; thorax much narrowed before, cinereous each side, a slight impressed dorsal line; base with the edge almost angulated, central lobe almost truncate; scutell quadrate, whitish, longitudinally divided by a dusky line; elytra with the interstitial lines having a slight appearance of alternating whitish and dusky; on the middle of the third interstitial line is a more abbreviated whitish line; posterior thighs with a black spine and two smaller ones.

Length over one-tenth of an inch.

The whitish or cinereous markings are not very striking; on the elytra they may sometimes be traced into two obsolete macular bands.

I obtained many specimens from the seeds of an *Astragalus* in August.

Prof. Riley has given in his *Third Report on the Insects of Missouri*, a detailed description of *B. fabæ*, which may also be referred to. The features upon which he separates it from *B. obsoletus* of Say are these: We give them that by their aid, *B. fabæ*, if it proves to be a permanent variety, may be identified from the comparison.

B. obsoletus is a smaller species, dark gray, with the antennæ all dark, the pygidium not rufous, the thorax with a perceptibly darker dorsal shade so that the sides appear more cinereous, a white scutell, and each interstitial line of the elytra with a slight appearance of alternating whitish and dusky along its whole length.

The *Bruchus fabæ* of Prof. Riley.

Following the description of *B. fabæ*, to which reference is made above, the description being too extended to give it place here, Prof. Riley has written as follows:

This insect has been for several years ticketed in some of the Eastern collections by the name of *B. fabæ*, or else what is worse, the corruption of it, *fabi*. * * * * * The name was credited to

Fabricius, but I can find no notice in any of the works that I possess of any European *Bruchus fabæ*, and several of my eastern correspondents who have access to large libraries have been unable to find any description or allusion to a species by that name. Dr. LeConte has given it the MS. name of *varicornis*, but as his description will not appear perhaps for years to come and as no comprehensive description has yet been published, I have deemed it advisable to dispel in a measure the confusion that surrounds the nomenclature of this species. There is need of a description of so injurious a species, and as *fabæ* is not preoccupied, I adopt the name because it is entirely appropriate, and because it is more easily rendered into terse popular language than *varicornis*.

The *Bruchus fabæ* of Dr. Fitch.

The origin of the name "*B. fabæ*" attached to the insect "in Eastern collections," for which Professor Riley was unable to account, finds full explanation in the two following MS. notes, and a long-time overlooked published letter of Dr. Fitch. The notes are extracted from one of the many manuscript volumes left by Dr. Fitch, which subsequently came into the possession of Dr. A. E. Foote, of Philadelphia. Not long ago they were purchased by Mr. S. H. Scudder, and by him presented to the Boston Society of Natural History. The notes have kindly been transcribed for me for present use by Mr. Samuel Henshaw, of the Boston Society, from whom I also received some months ago a copy of the letter referred to in the first note, printed in slip form (10x28 cm.), several copies of which were found among the MSS.

In his notes on *Bruchus fabæ*, Dr. Fitch had written as follows :

In August, 1860, I received from W. R. Staples, Secretary of the R. I. Society for the Encouragement of Domestic Industry, a small parcel of beans infested by insects, the result of my examination of which I communicated to him in the following letter, which was published in the Transactions of the Society for that year, page 62, this volume having been issued in February, 1861. He stated in the accompanying communication that the stored beans in the city of Providence were quite generally preyed upon by this insect. I subsequently learned that it was common in and around the city of New York and other places along the seaboard. And from the complaints made by prisoners in the late civil war of the wormy beans furnished them for food and which were so loathsome to them, I infer this insect to be common through the southern states. Mr. Riley having received specimens from Massachusetts ticketed as being the *Bruchus Fabæ* of Fab., and finding no such name in the works of Fab., describes it as a new species under this name in his 3d Report, p. 52.

The letter above referred to, and printed in the Transactions cited, and as a separate slip, is the following :

THE BEAN-WEEVIL.

W. R. STAPLES, *Secretary of the Rhode Island Society for the Encouragement of Domestic Industry:*

DEAR SIR. — Whoever inspects beans infested with the insect which you send me, will at once infer that this depredator is closely akin to

the well-known Pea-bug, or Pea-weevil, as it might better be called—the *Bruchus Pisi* of Linnæus — the beans being perforated with large round holes, similar to those in the pea, where the insect has escaped, or presenting a discolored spot, under which is a round cavity, in which the creature is still lying ; the only important difference being, that as the bean is a much larger fruit, several holes, usually as many as six and sometimes twelve, are bored in it, instead of the single hole which we see in peas.

And on inspecting this insect, I find it to be a weevil so similar in its general appearance to that of the pea, that persons who have not made this class of animals a special study, would probably infer it to be the very same insect, somewhat modified in consequence of its being reared upon slightly different food. But on a close inspection, it will be found to differ essentially from that insect, in many points of its structure and colors.

From the examination I am at present able to make, I do not recognize this as a species that has been heretofore described. I infer it has but recently been noticed in your vicinity, and it would hence appear to have been introduced, probably, from some foreign country. It, however, is unlike the *Bruchus rufimanus* and *granarius*, common insects in Southern Europe, which prey upon beans in this same manner. In addition to these, I see a Brazilian species has been named *B. Phaseoli* by M. Chevrolat, a name implying it to subsist on the bean; but I have not the work of this author at hand. Upon a kind of wild bean growing in Indiana, Mr. Say met with a beetle which he names *B. obscurus*, which appears to approach nearer to this insect than does any other species to which I can refer.

Under the circumstances, the best service I can render, will be, to present a name for this insect, with such a description of it as will serve to plainly distinguish it, and thus open the way for future researches to determine whether it really is a species which has lurked unnoticed in the world until the present time.

I would therefore name it the Bean-weevil — *Bruchus Fabæ*. It is slightly smaller than our Pea-weevil, its length being from 13 to 15-100ths of an inch. It is of a black color, more or less densely coated over with tarnished yellowish gray pubescence, and is particularly distinguished from other species by having the four first and last joints of its antennæ, and all its legs, of a rusty or pale dull yellowish color, with only the under side of the hind thighs black. Along the middle of its thorax is a faint whitish stripe, which has an impressed line at its hind end. Its wing-covers have impressed lines or striæ, the interstices between which are alternately of a faint whitish color, this color being most clear and distinct along the middle of the third interstice between two faint blackish spots, which are placed on this interstice, a few other blackish spots being also perceptible here and there, outside of this. The abdomen or hind body is pale dull yellow, with a black band on the fore-part of each joint, and its flattened tip, beyond the ends of the wing-covers, is obscure grayish, with a faint whitish stripe along its middle. On the under side of the hind thighs, near their end, is a little projecting spine, like the point of a thorn, with a similar very minute one at its hind base, followed by a more minute, blunt-pointed one.

The habits and transformations of this insect will probably be found to vary but little from those of the Pea-weevil; and the same remedies doubtless will be as efficacious against the one as the other. It is generally known that the Pea-weevil rarely injures the embryo or germ of the future sprout, and that "buggy peas" may consequently be used for seed; though the plants from them will probably be puny and feeble during the first stages of their growth. This Bean-weevil is a more inveterate enemy, for in most instances I find the germ is devoured, rendering the beans as worthless for seed as they are for food.

Yours respectfully,

ASA FITCH.

Following the above, after a short note about "Southern Beans fed to Prisoners of War," Dr. Fitch wrote :

Specimens were sent from Rhode Island in 1862 to the Boston entomologist, Mr. Sanborn, probably ticketed as "*Bruch. Fabæ Fl.*" The abbreviation was no doubt misread "*Fl.*" And thus this has become in the collections a Fabrician species. Mr. Riley finding that Fabricius had described no species under this name gives it as a new species in his 3d Report, p. 55. What is here presented will clear this matter of the misapprehensions which have been so widely prevalent.

A comparison of the descriptions of Dr. Fitch and Professor Riley, will show, as is also claimed by Dr. Fitch, that the same insect was described by each. It is worthy of notice in this connection, that Dr. Fitch was unable to refer his *Bruchus* to the description of *B. obsoletus* of Say (its comparison with "*B. obscurus*" Say is obviously a clerical error), although it is now claimed by our best authorities that they are but one and the same species.

Injuries of the Weevil.

A field attack of this insect, if allowed to continue without effort to check its progress, ordinarily results, within a few years, in the worthlessness of the crop, or its entire destruction. The insect multiplies with great rapidity, for unlike the pea-weevil of which but one larva occupies a pea, a score or more of this may be developed within a single bean. It appears to feed upon all the varieties of beans, none, so far as known, being weevil-proof. Professor Popenoe, in writing the present year of its operations in Kansas, states: "It has proved very troublesome here [in Manhattan] during the season just closed, and an examination of our stock of beans of about eighty sorts [in the Agricultural College] shows a destruction of the product varying in amount, according to the sort, from 2 to 60 per cent, the Broad Windsor and the Lima being alone exempt from attack." From other published accounts from different localities, it

would appear that the Lima is nearly as liable to attack as other varieties.

In regard to the amount of injury to the individual bean, Professor Popenoe has written:

The full-grown larvæ are often literally crowded together in the bean. This crowding often results in the entire destruction of the seed except the outer skin, which remains unbroken, thus often totally misleading the observer who sees no external injury except a very few minute white scattered punctures where the insect first entered the bean [?]. In the Dutch case-knife bean the larvæ were abundant, a single seed containing by actual count in one instance, as many as twenty-eight, while in other varieties the actual number was only less because the beans were too small to contain so many.

A package of the small baking bean (Marrowfat), averaging a half-inch in length, received from Mr. H. H. Morrell, of New London, N. Y., and now in the State collection, the weevils from which emerged in my office on the 11th of January, show burrowing to the extent that nearly the entire interior was destroyed, and leaving within the rind only a packed mass of yellowish fecal matter. Many of them—perhaps most—show from twenty to twenty-five weevil cells.

In further illustration of the possible multiplication of the insect when it has been left unmolested, the instance may be cited where, from two quarts of beans which had been hung up for seed, over a teacupful of beetles, as reported, were taken when they were opened for planting in the early part of June.

Infested Beans Should not be Planted.

It is hardly necessary to remark that beans containing the living insects should not be planted, as they would quite as readily give out the beetle as if left above ground; and, moreover, the beetle would thus be given every needed facility for reaching the plants as soon as they are in readiness for the reception of the eggs. Nor should weevil-eaten beans be used for seed; they can not produce healthful plants. This fact has been overlooked by a number of writers upon the bean-weevil, who have thought it sufficient to urge that care should be taken that all the beetles have left the seed, or been killed within it, before planting. It was for a long time believed that the presence of the pea-weevil in the seed rarely interfered with its germination. Thus Latrèille had written of it many years ago: "If the summer has been hot, the beetles are disclosed the following autumn, and the seeds will grow notwithstanding their inhabitants, which spare, owing to a wonderful instinct, the vital germ of the pea." Professor Westwood entertained nearly the same belief, for he also represents the larva as having "the curious instinct to leave the most vital parts of

the seed until the last" (*Introduc. Class. Ins.*, i, 1839, p. 330). Dr. Fitch had stated (see page 264): "It is generally known that the pea-weevil rarely injures the embryo or germ of the future sprout, and that 'buggy peas' may consequently be used for seed." But even if the germination was not seriously affected, the subsequent growth of the plant is an equally important (and until lately overlooked) consideration.

Experiments in Germination of Weevil-eaten Seed.

Professor Goff, formerly of the N. Y. State Agricultural Experiment Station at Geneva, has made valuable experiments in this direction, of which he has written:* "Our experiments showed that although pease that have been inhabited by the weevil will frequently germinate, they rarely make strong and productive plants. In one lot of fifteen seeds only two vegetated, and *but one made a vigorous plant*. In an experiment in germination with a larger number, 57.2 per cent of 'buggy' pease germinated."

A still more disastrous result from insect injury is reported by Professor Beal in the *Country Gentleman* for August 14, 1879, xlv, p. 519. Of 500 weevil-eaten peas planted, only 26 per cent (130) germinated, while of the same number of apparently sound peas, only four failed to germinate.

The pea containing but a single weevil, and the bean several — the number, at times, being only limited by its capacity — it would naturally be expected that the operations of the bean-weevil in interfering with germination and subsequent growth would be the more disastrous of the two. This, in part (so far as germination alone is considered), is clearly shown by recent observations reported by Professor Popenoe, as having been made in 1889, at the Kansas State Agricultural Experiment Station, as follows:

A large number of infested beans of different varieties were carefully examined, and the proportion of cases noted where the vital part of the seed had suffered material injury. This examination showed many cases where the plumule was entirely cut through at different points, and others again where the radicle was partially or totally eaten up, and the cotyledons eaten from their attachments. In the greater number of such cases, the injury was sufficient to preclude healthy germination.

Experiments Contradict Former Belief.

The statement — apparently quite at variance with the above observations — made by Professor Riley in his third *Report on the Insects of Missouri*, in 1871, that he had "always found the germ either untouched

* *First Annual Report of the New York State Agricultural Experiment Station*, 1883, p. 142

or but partially devoured even in the worst infested beans," may require this explanation: at the time of writing, the bean-weevil had only been known in Missouri for a year or two, and had not as yet become abundant. If Curtis, in his "Farm Insects," in commenting on Latrèille's remark that by a wonderful instinct of the weevil "the vital germ of the pea is spared," was correct in stating, "this is the case with the beans also," and again on page 361 *loc. cit.*, "as the beetles [*Bruchus granarius*] generally leave the germ uninjured, the vitality of the infested seeds is not destroyed"—then certainly the bean-weevils of Europe must be less injurious in their feeding operations than is our species. Dr. Fitch—always accepted as a careful observer—has distinctly stated (as already quoted), "in most instances I find the germ is devoured." My own examinations of infested beans are in accord with this, for in no case have I found a bean of the ordinary size used for baking, which has nurtured more than five larvæ, in which the germ has remained intact.

Experiment in Testing Vitality and Productiveness.

But beyond the question of germination, there is still another quite as important—the vitality and productiveness of the plant after its stalk and leaf development. Where a full crop is desired, and when is it not, beans *even but slightly injured should not be used for seed*. This is proven beyond all question by the careful experiments made and reported by an eminent English entomologist, Mr. Theodore Wood.

For the purpose of ascertaining the precise degree of injury caused by *Bruchus rufimanus* in beans, twenty were selected from a large lot of infested material, three of which had been perforated by three weevils each, five by two, and twelve by one only. They were sown under the most favorable conditions for insuring uniformity in growth and general welfare.

The young plants showed strong and vigorous growth, and were apparently none the worse for the injury that the seed had received. But when the time for fruiting came, a great change was evident. The blossoms were few and small; the foliage faded and withered; and several of the plants died without producing a single pod. Mr. Wood further states:

Of the first three plants, raised from seed pierced by *three* weevils, one was altogether barren, while the remaining two bore but three pods between them, none of which arrived at perfection. The next five grown from seed tenanted by *two* beetles only, were slightly more fruitful, bearing in all six pods, of which five reached their full growth; two of these five plants, however, were barren. Upon the remaining twelve, the seed of which had but one perforation, I

counted twenty-three pods, not more than ten of which arrived at maturity. Only one plant of this latter was entirely unfruitful. It will thus be seen that the twenty plants bore among them but thirty-two pods in all, of which less than one-half came to perfection. The bean in question, I should mention, was not one of the most freely-bearing varieties, six pods being the average yield of each plant. (*Entomologist's Monthly Magazine*, xxii, 1885, p. 114.)

A comparison of the above yield with that sown at the same time from uninjured beans, warranted Mr. Wood in claiming, as "proved beyond all question, that the presence of the beetle [to the extent above stated] is highly prejudicial, not to the germinating qualities of the seed, which appear to be uninjured, but to the reproductive capabilities of the adult plant."

That Mr. Wood might with propriety have been even more emphatic in his conclusions, will appear when the result of his experiment is presented in the following form: Beans averaging only one and one-half weevil perforations, produced less than 27 per cent of the average number of pods, and not exceeding 13 per cent of an average matured crop.

It should be stated, however, that a somewhat greater injury might be expected to accrue from presence of *B. rufimanus* than from that of *B. obsoletus* — ours being about one-fourth less in size, or in the proportion of 0.12 inch average length to 0.15 inch in the European species.

Infested Beans Unfit for Food.

While beans that had been infested with the weevil would not be given place on the table, their value for feeding to stock would not be materially impaired; but so long as they contain the beetle, and it is not always very easy to determine this condition without opening them for examination, it might be hazardous, to say the least, to feed them to our domestic animals.

Curtis relates:* "An alarm was spread in some parts of France, in 1780, that people had been poisoned by eating worm-eaten pease, and they were forbidden by authority to be exposed in the market." The pease were given scientific examination, and the insect found to be the pea-weevil *Bruchus pisorum*.

A small lot of beans was submitted to Dr. Curtis, in 1845, for examination, by the Secretary of the Royal Polytechnic Institute, which had been sent from Sicily by a cabriolet proprietor whose horses had become much deranged in their health by feeding on them. Less than one-half of the beans were found to contain from one to four Bruchids, to which the name of *Bruchus flavimanus* was given by Schönherr.

* *Farm Insects*, 1860, p. 362.

Epitome of Life-History of the Bean-weevil.

I do not know that the eggs of the beetle have been observed on the growing plant, but its oviposition is presumably similar to that of the pea-weevil, as stated by Dr. Harris:

After the pea-vines have flowered, and while the pods are young and tender, and the peas within them are just beginning to swell, the beetles gather upon them and deposit their tiny eggs singly in the punctures or wounds which they make on the surface of the pods.

Professor Riley's account varies somewhat from the above in the matter of placing the egg, in that "the beetles deposit their eggs on any part whatever of the surface without attempting to insert the egg within the pod." He describes the eggs, which "are fastened to the pod by some viscid fluid which dries white and glistens like silk."

The egg of the bean-weevil hatches in from eight to ten days, and the larva, penetrating the pod, enters the young and growing bean. When, as is usual, several occur in a single bean, each one occupies a distinct cavity where it feeds and attains its growth. When in readiness for pupation it shapes for itself a broadly oval cell with firmly compacted white walls, within which it transforms to a pupa and finally into the beetle. The larva, under normal conditions, reaches maturity in the late summer, and pupates in the autumn. The length of time ordinarily passed in its pupal stage is unknown, if we may judge from the absence of record of it.

As in most cases, the circular covering of the cell (the lid) has been eaten away upon its inner surface, its faint translucency in colorless beans indicates to careful inspection the presence of the insect within; this is more conspicuous when the maturity of the beetle permits its darker colors to be indistinctly seen. The emergence is by pushing off the circular cap. The time when this takes place is irregular. It may be in the late autumn, at any time during the winter months in a warmed apartment, or not until the spring when not exposed to artificial warmth. For some reason the perfect beetle frequently remains within its cell for months before it comes abroad, and is often found dead, without apparent cause, within the bean. I have at times found the beetle head downward in an open cell, as if it had crept within it for the purpose of feeding.

A Brood of Dwarfed Bean-weevils.

Examples of this beetle were received March 11th, for name, with the statement that they were present in countless numbers in a dwelling-house in Waterbury, Conn., occurring most abundantly in the kitchen. The gentleman was surprised at the appearance of such a display of insect life during the winter, and was inclined to ascribe

its source to the fuel which was being used for the kitchen fires, which consisted largely of the timber from a livery stable that had been torn down during the preceding summer.

In answer, the name was given and the assurance that they could not have had their origin in the source supposed, as that would be incompatible with their well-known habits, but that in all probability, if search was made, some overlooked bag or package of beans would be found from which they had escaped. A few days later, a letter was received, announcing that a paper bag of beans had been brought to light still swarming with the beetles and perforated with innumerable holes through which they had escaped.

The specimens of which there were many, were uniformly at least one-half smaller in size than the examples that had previously come under my observation — the difference being so marked that I was unwilling to trust my identification of the species until it was confirmed by Dr. Horn. In all probability the larvæ had been dwarfed in size from an insufficient food-supply, from the oviposition having been unusually abundant, or possibly, from a second brood having been produced from the same lot of beans. The "countless numbers" in which the beetles appeared would seem to lend color to the latter supposition, although I could find no record of such an occurrence, nor had I previously deemed it possible, believing that ripened and dried beans could not serve as food for the tender larvæ. I was not able to learn how long the bag of beans had been kept in the house.

Are There Successive Broods Within Stored Beans?

Addressing an inquiry to Mr. E. A. Schwarz, of the Entomological Division of the Agricultural Department at Washington, who is perhaps our best authority on the early stages of the Coleoptera, if he had any knowledge, either personal or from record, of the bean-weevil undergoing all its changes within ripened and stored beans — with his usual kindness, the following reply was sent:

Although I can not refer you offhand to any special publication, I am positive that there have been observations published showing that *Bruchus obsoletus* is able to breed for at least two consecutive generations in the same lot of beans, so that the second generation oviposits on, and the larvæ develop within, the dry beans. In the Cow-pea *Bruchus* (*B. scutellaris*) this fact is well known and the beetle seems to be able to live for an indefinite number of generations in the same lot of beans. I also know that the Gleditchia *Bruchus* (*Spermophagus robinæ*) has been bred in at least two consecutive generations from the same lot of seeds.

Professor Popenoe has recently expressed his belief that he has found evidence that the beetles continue to breed and develop in

dried beans, in that some early matured varieties that had been placed in bottles with loose corks early in September, when again examined in January, 1890, were found to contain "larvæ of all sizes, pupæ, and adult weevils, as well as the empty cells whence adults had escaped earlier."*

The Fact of Successive Broods Established.

The question raised as above, of the ability of the bean-weevil to produce, not only a second generation from the beans in which the first was developed, but also successive broods limited only by the food-supply, has been satisfactorily determined in the affirmative from observations made by me during the past summer.

Oviposition.—A number of the beetles were sent to me September 4th by Dr. H. C. Coon, of Alfred University, Alfred Centre, N. Y., for name, etc. When received they were alive and active, and had deposited a number of eggs upon the side of the phial in which they were inclosed. The following day, for better observation, the beetles were removed to a jar, and furnished with some sound and uninjured beans. It was thought that they might perhaps eat into them for oviposition, but no attempt of the kind was made. Examining them with a magnifier on the 10th of September, quite a number of eggs were found on their surface, sometimes placed singly, but oftener in clusters of three, four, or five. They were white, smooth, narrower at one end (the lower, when attached at an angle), and with a length nearly three times that of their greatest breadth (as 10 to 29 on a scale). Larvæ from them were observed on the 17th, traveling incessantly over the smooth surface of the beans.

The egg-laying was continued — upon the beans only — for a few days longer, and by the 23d the last of the beetles had died.

The larvæ entering the bean.—The larvæ were carefully watched with a strong glass, but no effort seemed to be made by them to burrow into the bean. The earliest hatched by degrees became more quiet, then ceasing their travel and dying — their bodies adhering to the surface and assuming a pale yellow hue. As an experiment, the rind of the upper surface of two beans was pierced in several places (six in the one and ten in the other) by revolving upon it the fine point of a knife-blade. The punctures were very soon discovered by the larvæ, and they at once commenced to burrow into them. By the following day each puncture had been appropriated by a larva which was actively engaged in boring its way slowly into the hard substance — about a day being required to remove itself entirely from sight. The

* In *Second Ann. Report of the Kansas State Agricultural Experiment Station* for 1889 1890, pp. 208-9.

material excavated was thrown out in a powdery, adherent, irregular mass, presenting a flocculent appearance. Two smaller punctures made with the point of a needle, were also entered by larvæ.

At about the same time, two larvæ were observed entering the bean where no puncture had been made to aid them.

It is possible that they may have been guided and aided by some minute opening, but no fracture or other injury adjacent was discoverable even under a high magnifying power. With the locality known, the points where they had entered could be barely detected with a glass.

The egg-shells which remain in place are transparent, and entire with the exception of being irregularly broken at the larger end from which the larva escaped.

The third or fourth brood of the insect.—It was subsequently learned from Dr. Coon that the beans had been in his house for two or three years: from this fact, it is evident that the beetles received were at least the third or fourth brood* that had been produced therefrom. It is probable that but a small portion of the year is required for a generation when the larvæ are permitted to feed and develop within doors during the winter months, and this would explain why the beetle is frequently sent to us for name at other seasons than at the time of its normal appearance.

Oviposition on infested seed.—From the readiness with which the beetles oviposited, as above narrated, the inference may be drawn that it is their habit when confined with the beans, to mate and at once proceed to lay their eggs. Even if the eggs should not be placed within the holes from which the beetles had emerged, the young would enter them and find no difficulty in penetrating from thence into the solid interior.

Transformation to the final stage.—Much to my surprise, not long after writing the above (which is allowed to stand as written, although perhaps needing modifications in a few particulars), the completion of the life-cycle, the early stages* of which are above noted, was observed by me in season for embodying in the present report.

Happening to look at the beans early in November, indications were apparent of the recently microscopic larvæ having been transformed into the mature insect. The lids of numerous cells were defined and their rims cut in readiness for removal. Raising one of them, on November 6th, a fully matured beetle was drawn from beneath it. Eggs deposited between September 5th and 10th, had given the

* See remarks beyond on the possible number of broods.

perfect insect *two months thereafter*. Two or three days later the beetles began to emerge. One of the beans was then dissected, giving the following as its contents:

No larvæ; three pupæ, entirely white except the dusky crescent of the eye; one pupa or beetle* (?semi-pupa), with dusky eyes and faint gray color to the wings which lie on the ventral surface; one imago with brown beak, antennæ and crumpled wings blackish, elytra yellowish and carried over to the side, darker basally, and showing characteristic markings; one imago with the elytra on the back, the wings fully extended from beneath them, thorax and legs yellowish-brown; four imagoes of nearly normal colors above, wings still extended, segments of abdomen beneath dark brown anteriorly and pale over the incisures; one imago, with wings folded beneath the elytra, and perfect in every respect and creeping out of its cell when opened — in all, eleven individuals, which have been preserved in alcohol.

Fifty-four beetles have emerged up to the time of present writing (November 28th) from the eleven beans inclosed in the box where oviposition took place. One of the beans was intact; the others gave respectively 1, 3, 5, 8, 10, 13, and 14 beetles. A few of the cells still contain the insect.

To conclude the history of this brood: Eggs were observed from them on November 20th, and at the present time they are freely ovipositing.† The successive broods, of which this may be the tenth, allowing two and a half months for a brood, would doubtless all have occurred within the beans where they originated, had they been retained there and their food-supply continuing sufficient for them.

As showing the extent to which the insect may be dwarfed through insufficient food-supply, it may be stated, that from the most largely infested bean (fourteen beetles emerged and five still inclosed) and from a portion where the cells were more closely clustered, a beetle was withdrawn of only about one-third the average size; the lid covering it was almost in miniature.

How the larva enters the bean.—As may be seen from what has been written, the larva, as it leaves the egg, is able to burrow through the

*From my lack of knowledge of the transformations of the *Bruchide* (which may possibly be peculiar) I know of no other indication of the final stage than the appearance of the wings from beneath the elytra. This occurs while the elytra lie upon the ventral surface, whence, with deepening coloration, they are by degrees carried over to the sides and upon the back.

† The brood from this oviposition commenced appearing early in February, 1891, and the 14th of the month some of the eggs were placed in a small bottle with beans. From these eggs beetles were obtained on May 2d, 1891. These again ovipositing in a large jar of beans, the jar was found to be swarming with beetles on July 3d, some of which must have been out for several days.

testa (shell) of the ripened and dried bean without the need of a fracture, or puncture such as was made for it in the present instance. But that this may be done — if we may judge from the number of dead larvæ observed, and on the supposition that they were from eggs deposited upon the sides of the box — it is highly probable that the aid given the larva by the walls of the egg-shell while still within it, in concentrating, guiding, and sustaining its muscular efforts, or that afforded by some surface in contact, as of an adjoining bean or the inclosing bag or jar, is essential to its effecting an entrance. That the punctures made in two of the beans, as previously stated, were utilized by the traveling larvæ, appears from the fact that they contained the largest number of beetles, viz., eighteen and nineteen, as against an average of five in the others.

The lid, cut by the beetle for its release.—The exit of the *Bruchus* through a circular or oval neatly-cut lid, evincing so much design in its construction, has been stated by numerous writers. Over a century ago the distinguished French entomologist, Olivier, had represented the larva as cutting a channel to the outer covering of the seed, and leaving it so thin that the slightest effort suffices to open it. Dr. Harris repeats the statement. Dr. Packard, more recently, has written: "The insect escapes through a thin orbicular almost transparent lid, previously gnawn by the larva, which falls when the beetle emerges."

That the lid is made by the larva seems to have been accepted by all who have written of it. It is, however, not formed at this stage of the insect's life, but later, by the beetle. The larva, guided by instinct, carries its burrow outwardly quite to, and partly within, the shell, where a semi-transparent irregular spot in which the burrow terminates locates the proper place for the pupal cell. Here the cell is made and pupation follows. When the final transformation has taken place the beetle commences to feed at the ruptured end of its cell, and eats into the shell—not at the semi-transparent spot above-mentioned, but removed a little way therefrom, perhaps slightly more than the cell's length.

The first indication of the construction of the lid is a small translucent crescent, rather sharply defined on its convex side. The crescent continues to grow in size and to extend the measure of its limb and the translucent portion within, paralleling the increase of the growing moon, until, like that, it becomes full-orbed. The few adhering grains of the body of the shell are next dissected away, and finally, when the time for emergence has nearly come, a cutting is made into the lid around its entire circumference, leaving it attached by hardly more than a film. This, of course, is done by the man-

dibles of the beetle, and the cutting is after this manner: an incision being first made, its extension is continued as the beetle slowly rotates for the purpose within its cell—one revolution completing it—its outline being defined by the position of the beak.

[[Two or three dark-colored excremental rods may be left within the cell (together with the cast and flattened mass of exuvia), as the result of the feeding that has taken place therein.

Remedies.

[[After this perhaps too extended discussion of a minute insect, if aught relating to the history and habits of any of our insect pests can be in excess, it yet remains to consider the remedies available against the bean-weevil.

It follows from what has been written, that one of the popular remedies oftentimes presented for its control, viz., keeping over the beans until a second year, by which time the beetles will have emerged and died, leaving the seed safe for planting, must henceforth be discarded, as of no value whatever.

As yet we know of no preventive of the deposit of the eggs upon the young plant. If the season for oviposition of the parent beetle were quite limited, which unfortunately it is not, the entrance of the newly hatched larva into the pod might perhaps be prevented by the same means used for the destruction of the young caterpillar of the codling-moth—giving it, by spraying, an arseniated surface through which to penetrate.

The best remedies are undoubtedly to be found in the destruction of the insect, as soon as may be, after the ingathering of the crop. This may be accomplished in a number of ways, among which are these:

Heat.—The beans may be thrown into hot water for nearly a minute. It is stated, but we do not know if as the result of careful experiment, that they will bear immersion in water at the boiling point for one minute without injury to the germ. We would prefer recommending hot water below the boiling point for about a half-minute. Examination would show if this was sufficient. If not, testing the germination of small lots would indicate if a higher temperature or longer exposure were safe. Will not some of our experiment stations make careful tests of the different varieties, the more and less hardy, and report authoritatively.

Mr. Weed, of the Ohio Agricultural Experiment Station, reports that exposure to a temperature of 145° Fahr. continued for one hour, killed the grubs of the pea-weevil contained in newly-ripened pease,

about the middle of July, at which time the insect was but about half-grown. In the experiment a gasoline stove-oven, heated by a kerosene lamp placed underneath, was used. It is thought that the same means would be effective with infested newly ripened beans, but probably a somewhat higher temperature would be required. (*Seventh Rept. O. Agr. Exp. St., loc. cit.*)

Kerosene.—A communication to the *Country Gentleman*, of April 5, 1883 (page 277), from a lady in Virginia, states, that in a fit of desperation over a bag of badly infested beans kept for seed, she poured kerosene over them until they were saturated, and laid them aside in the seed drawer for further developments. When they were examined in the spring, a quantity of dead beetles were in the bag which had doubtless been killed by the kerosene, and all of those that remained within the beans were also dead. A test of the beans for germination showed in their vigorous growth that they had not been injured by the application. The writer concludes with: "I shall never plant beans again from any source without first applying coal oil, and if all our neighbors will do the same, we may entirely drive the weevil out of the country." This remedy could not be recommended where beans are kept for food.

Bisulphide of Carbon.—Exposure to the vapor of this volatile liquid, is an infallible means of killing our bean and pea weevils. The infested beans may be put in some tight vessel, box, or bin, with a cup containing bisulphide of carbon upon them, covering up closely, and leaving them for a day or two. The heavy vapor (about two and one-half times heavier than common air) given off will descend and kill all the animal life present, without injury to the germ, or impairment for use as food after suitable exposure to the air. This valuable insecticide—available against a large number of our insect enemies—may be purchased at drug-stores, at the moderate price, by the pound, of about thirty cents. A small quantity of it will suffice. It has been found, in experiments on a large scale made in India for killing the weevils that there infest stored grain quite seriously, that one pound and a half is amply sufficient for use in a ton of grain, provided that the grain is inclosed in tight vessels. As the vapor is quite inflammable, precaution should always be taken not to bring a light in contact with it.

The sooner that the remedy is applied to the infested beans after their ripening and gathering, the greater will be their value for food. As at that early time, the presence of the insect within is not so readily detected, it would be wise, if in all localities where it has obtained a foothold, that examination be made before storing, either

by careful inspection of the surface, or, what would be preferable, opening a number and examining their interior.

It is evident, in the light that we now have, that this pest may not be exterminated from a locality by the refraining, by common consent, for a year or two, from the culture of the bean, as we have previously recommended, for the insect may be safely "tided over" during that time by continued generation within the stored crops, or in the housewife's bag of beans carefully laid aside and protected in some bye and forgotten drawer.

The Tracy house.—Perhaps in no way could as much be accomplished toward arresting the spread of this insect, as in the use, by all extensive bean-growers, of the "Tracy house," or "bug-house," which, according to Professor A. J. Cook, was largely used by the pea-growers of northern New York, for the arrest of the ravages of the pea-weevil, when not long ago the pea interest was threatened with destruction. Professor Cook has given the following description of the house and the manner in which the bisulphide of carbon is used in it:*

"The house is made air-tight; even the door is made very close-fitting; and is made still closer by pasting paper over the edges upon closing it, after filling the house with sacks of peas. An air-tight flue at one end opens at the very top into the building, and at the bottom out of doors. A sort of shoot with an adjustable air-tight valve is arranged for the turning in of the liquid. The liquid is turned in till the odor shows that the vapor is pouring out at the bottom of the flue. Then, of course, the air has all been forced out by the vapor, when the valve is closed. It is left closed for three days; then the doors are opened that the vapor may escape, when all the weevils will be dead."

What Should be the Insect's Name?

During the preparation of this paper, I have been led to question the propriety of retaining for it, Say's name. There is certainly reason for doubting its being the species which, he has briefly and insufficiently described as having been bred by him from the seeds of *Astragalus* in Indiana. I offer the following considerations:

1. For many years after its discovery at Providence, R. I., it was only observed along, or not far from, the Atlantic seaboard—quite remote from "Indiana" and "Louisiana."† Its westward distribution seems to have been quite gradual, in later years.

2. No one has since bred the *Bruchus* from *Astragalus*. As a rule, the *Bruchidæ* confine themselves to a single food-plant. Dr. Horn, in

* Bulletin No. 58, Michigan Agricultural Experiment Station, St. Agricul. Coll., Ap 1890. Insectides. (Bisulphide of Carbon, pp. 8-12.)

† Say gives Louisiana as the habitat of *B. obtectus*.

his Monograph of the Bruchidæ of the United States, has stated: "each species appears to prefer a special plant, or at most, restricts its attacks to the species of one genus." In Dr. Gray's arrangement of the Leguminosæ, *Phaseolus* is separated from *Astralagus* by *Wistaria* and other genera. Is it not probable that whenever the *Astralagus* *Bruchus* shall again be bred, that it will show itself to be quite distinct from the "*obsoletus*" of Dr. Horn?

3. Say's description is so indefinite and general, that our bean-weevil can not be positively referred to it. The type, unfortunately, is not in existence, and therefore the insect that Say had before him can only be reached through conjecture and probabilities. Dr. Horn, while he expresses his confidence of his interpretation of the species, can only claim that Say's description "fits the bean-weevil fairly well."

4. Dr. Fitch had no thought of the Rhode Island beetles being the *obsoletus* of Say: it appeared to approach nearer to it than did any other species to which he could refer. Dr. LeConte was equally unable to identify it with *obsoletus* Say, and had therefore described and named it in MS. as *Bruchus varicornis*. Dr. Riley also felt assured of its being an undescribed species, and therefore designated it, with careful description, as *B. fabæ*, indicating several important features in which it differed from *B. obsoletus*. Subsequent study has not led him to change his views.

5. If it was deemed necessary to fit Bruchids into Say's names, why was it not thought proper first to supply the hiatus of "*obtectus*," which precedes that of "*obsoletus*" in description, and is regarded as identical with it by Dr. Horn? In this we have the peculiarly colored antennæ of the bean-weevil described (so marked a character that Dr. LeConte selected it as a specific designation), the omission of reference to which is strikingly apparent in "*obsoletus*," and a strong argument against our present employment of the name.

It would better accord with custom and the rules of nomenclature if, instead of clinging pertinaciously to Say's name, in the belief that we know the insect to which it was applied, that it be rejected on the ground of its having been accompanied with merely a definition—without description such as leaves no room for reasonable doubt. Such rejection has been repeatedly made, as notably with scores of Walker's "species." In that event—as the description of Dr. Fitch unmistakably indicates our bean-weevil, and as it has priority of, and fully accords with, the "*varicornis*" of LeConte, the *fabæ* of Riley, and the *obsoletus* of Horn—"obsoletus Say" would give place to *fabæ* Fitch.

I have retained (under protest) the name of *Bruchus obsoletus* in this paper for present convenience, and not desiring to be the first to depart from the nomenclature presented in Dr. Horn's *Monograph of*

the *Bruchidæ* — a work which we have gladly accepted as a standard for our species.

NOTE.* — It is not improbable that the question above discussed of the respective claims of the two names for recognition and acceptance may ere long be set at rest through supersedence of one or both by some earlier name. Recent studies in Europe have brought to light several other names and descriptions (see in the bibliographical list given herewith), of which Reitter in his *Catalogus Coleopterorum Europæ, Causasi et Armeniæ Rossicæ*, 1891,† claims priority for *irresectus* Fahræus. It seems that *irresectus* was first named and described by Fahræus in Schoenherr's *Genera et species Curculionidum*, vol. v, 1839, page 18, (Habitat in Asia). If its identity, claimed by Reitter, with our "*obsoletus*" shall be hereafter satisfactorily established, the name would at least have priority over *fabæ* Fitch, and perhaps obtain acceptance, if "*obsoletus*" is abandoned, or transferred to the Astralagus weevil, when found.

Bruchus rufimanus (Boheman).

The European Bean Bruchus.

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

Bruchus rufimanus BOHEMAN: in Schoenherr's Gen. et Spec. Curcul., i, 1833, p. 58.

Bruchus granarius Linn. WESTWOOD: in Mag. Nat. Hist., for 1834, p. 257; Introduc. Class. Ins., i, 1839, p. 330, f. 40. 1-6 of p. 324.

Bruchus rufimanus. STEPHENS: Manual Brit. Coleop., 1839, p. 265.

Bruchus granarius. HAGEN: in Landwirth. Jahrb. aus Ostpreus., xi, 1859, pp. 161-162.

Bruchus granarius Linn. CURTIS: Farm Insects, 1860, p. 358, f. 53, 5-10 (description, habits, etc.).

Bruchus granarius Linn. RILEY: in Amer. Entomol., ii, 1870, p. 126-7, f. 85 a, e, f (identified from Switzerland); 3d Rept. Ins. Mo., 1871, pp. 50-52, f. 18 (description and habits from Curtis), p. 56 (erroneous reference).

Bruchus rufimanus. BATHVON: in Amer. Entomol., ii, 1870, p. 119 (quotes description from Stephens' Manual).

Bruchus rufimanus. WOOD: Insects at Home, 1872, also 1887, p. 162, pl. xvi, f. 4.

Bruchus granarius Linn. LE BARON: 4th Rept. Ins. Ill., 1874, p. 129 (imported in U. S.).

Bruchus granarius Linn. THOMAS: 6th Rept. Ins. Ill. [1877], p. 129 (characters and brief notice as imported from Europe).

Bruchus granarius Linn. ORMEROD: Manual Inj. Ins. [1881], pp. 8-11, f. 1-8; 9th Rept. Inj. Ins., 1886, pp. 6-8, figs. 1-8 (history, injury, remedies).

* This note is appended, November, 1891.

† See notice by Dr. John Hamilton in *Psyche*, vi, 1891, p. 147.

- Bruchus granarius* and *B. rufimanus*. DIMMOCK: in Cassino's Stand. Nat. Hist., 1884, ii, pp. 331, 335, fig. 375, b, c (mention).
- Bruchus granarius* Linn. WHITEHEAD: Rept. Ins. Inj. Gr. Britain, 1885, pp. 57-58, f. xvii, 1, 2 (brief notice).
- Bruchus rufimanus* Boh. WOOD: in Entomol. Month. Mag., xxii, 1885, p. 114; in Trans. Ent. Soc. Lond., Oct., 1886, Part III, pp. 375-380 (productiveness of infested beans).
- Mylabris rufimana* Bohm. BAUDI: in Deuts. Entomologische Zeits., Heft ii, 1886, p. 104, no. 20 (description and distribution).
- Bruchus granarius* L. FLETCHER: in Rept. Min. Agricul. Canada, for 1888, p. 55 (imported in beans from Europe).
- Bruchus granarius* Schön. WHITEHEAD: 2d Ann. Rept. Agr. Adv., 1888, pp. 49-51, f. 17 (injuries, transformations, prevention).
- Bruchus rufimanus* Sch. HAMILTON: in Trans. Amer. Ent. Soc., xvi, 1889, p. 150; in Entomolog. Amer., vi, 1890, p. 43 ("*B. rufimanus* Bohm. should be dropped" — ? from our lists).
- Bruchus granarius* Curtis; *Bruchus rufimanus* Boh. ORMEROD: 12th Rept. Inj. Ins., 1889, pp. 19-24, figs. 1-8; Manual Inj. Ins., 2d Edit., 1890, pp. 5-9, f. 1-8 (description, prevention and remedies).
- Bruchus rufimanus* Schönh. RITZEMA Bos: Tierische Schädlinge und Nutzlinge, 1891, p. 293, f. 162.

A Common European Insect.

Bruchus rufimanus is the common bean-weevil of England, where it fills the place that is held in this country by *B. obsoletus* in its injuries to beans, while at the same time covering a broader field, as it infests

pease largely and also feeds in other of the *Leguminosæ*. From this range of food it has come to be known as the "grain beetle" and the "seed beetle," and until recently has borne the scientific name of *Bruchus granarius* — erroneously given it, as will be seen hereafter. Fig. 18 (part) represents it in its transformations and bean infestation.

It is both a common and destructive species in England, as appears from many writers. Curtis states of it: "This species, which is everywhere abundant early in February on the furze

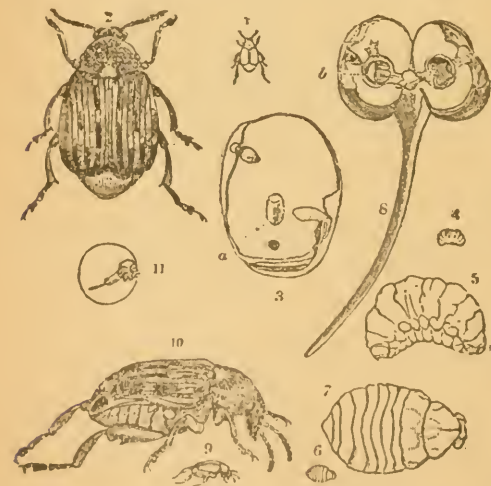


FIG. 18. — The European bean-weevil, *BRUCHUS RUFIMANUS*: 1 and 2, in natural size and enlarged; 3, infested bean; 4 and 5, larva in natural size and enlarged; 6 and 7, pupa ditto; 8, an infested bean showing subsequent vegetation. Nos. 9, 10 and 11 are of *BRUCHUS PISORUM*. (After Curtis.)

[? *Ulex Europæus*] when it is in bloom, inhabiting also the flowers of

various other plants in the beetle state, as the rhubarb, meadow-sweet (*Spiraea ulmaria*), &c., is a most destructive insect in our pea and bean fields, the larvæ feeding in the seeds and sometimes destroying more than half the crop. They are exceedingly abundant in some parts of Kent, where they often swarm at the end of May, and are occasionally found as late as August." (*Farm Insects*, 1860, p. 361.)

Not Naturalized in the United States.

It is strange that this weevil has never become naturalized in this country, as it was introduced many years ago, and no special effort so far as known was made to stay its spread. The only authoritative published records of its occurrence in the United States are these, each referring to the same event:

Its Occurrence in New Jersey and Canada.

Professor Riley, in 1870 (*loc. cit.*), identified as *Bruchus granarius* examples received by him from Mr. A. S. Fuller, of Ridgewood, N. J., who had discovered them in some pods presented to the "Farmers' Club," which the donor had gathered from a tree in Switzerland, thought by Professor Riley to be a species of *Liburnum*. Dr. Horn, in his *Revision of the Bruchidae of the United States*, 1873, adds to his description of *Bruchus rufimanus* Schön.: "This species was sent me by Mr. C. V. Riley, of St. Louis, as having been reared from pea-pods imported from Switzerland." Dr. Hamilton, in the *Transactions of the American Entomological Society* for 1889 (*loc. cit.*), quotes the same introduction.

Other writers, as Le Baron, Thomas, etc., have made simple mention of its having been introduced into the United States in recent years.

It has also been imported into Canada. Mr. Fletcher, in his Report as Entomologist and Botanist of the Department of Agriculture of Canada, for the year 1888, states that some infested seed of the large Windsor bean, which had been imported from Europe, had been sent to him for examination, and was found to contain living examples of the weevil (noticed as *B. granarius* L.), many of the beans containing from two to three each.

The identification by Dr. Packard, in *Injurious Insects, New and Little Known*, 1870, of bean-weevils received by him from the vicinity of New York City as the European *Bruchus granarius* [*B. rufimanus*], was in error, as appears from the appended description and the correction made by himself the following year in his *First Annual Report on the Insects of Massachusetts*.

Erroneously Reported from Tennessee.

Mr. E. W. Doran, formerly Assistant Entomologist to the Bureau of Agriculture of Tennessee, in his *Report on the Economic Entomology of*

Tennessee, 1886, in noticing *Bruchus granarius* Linn., states: "This is a European insect, but was imported into this country many years ago.

* * * * * It has not been considered injurious in this country. I have seen no account of any injuries caused by it, yet I am able to report it as being *very* injurious in this state." Following, an account of its abundance in pease offered for sale in the London market, is given. The differences between it and *Bruchus pisi* [*pisorum*] and *B. obsoletus* Say are pointed out, and it is therefore evident that the species had been identified with the one now known as *B. rufimanus*. Dr. Doran, in compliance with my request for information of the occurrence of the insect in Tennessee, has kindly sent me a number of examples collected at the time of his report upon it.* They proved to be *Bruchus scutellaris* Fabr., or, as recently pointed out by Dr. Hamilton, *B. Chinensis* Linn. It is a common species in pease throughout the southern states. A notice of it is contained in my 6th Report, which please see and correct the statements made in "Its Probable Life-history" respecting oviposition, inability of the larva to enter ripened seed, and the time for emergence of the imago—as subsequent observations (recorded in preceding pages) have shown them to be erroneous.

The Confused Synonymy of this Insect.

To the above brief notice of the European bean-weevil, it may not be ill-timed to add a few words in relation to its mixed synonymy, which has long been an embarrassment to me, and, doubtless, the same to many others.

Referring to Curtis' admirable volume on *Farm Insects*, London, 1860, on page 358, we find figure 53 illustrative of *Bruchus pisi* and *Bruchus granarius* (given on pages 359 and 360), each credited to Linneus; on page 363, *Bruchus flavimanus* is described and credited to Schönherr, *Genera et Species Curculionidum*, vol. i, page 59.† Figure 53 is presumably among those of which Mr. Curtis in his Introduction to the above volume states: "Nearly all the drawings have been made by myself from nature, and were engraved under my own inspection."

The above figure has been repeatedly copied by subsequent writers. Miss Ormerod, in her Ninth Report for 1885, continues for the "Bean Beetle; Seed Beetle," the name of *Bruchus granarius* Linn. In her

* A parasite bred by Dr. Doran from the London infested pease, as noticed in his Report cited, was sent with the above. It was in poor condition, and the last one remaining in his possession. Mr. L. O. Howard thinks it may be an undescribed species of Mr. Ashmead's new genus, *Bruchophagus* (*Insect Life*, iv, 1891, page 49).

† This species is mentioned incidentally here, it being a British species (see page 284), to correct an erroneous reference of it to *B. rufimanus* in Riley's 3d Report on the Insects of Missouri, page 56.

Twelfth Report, for 1889, and in the second edition of her *Manual of Injurious Insects*, it appears as "*Bruchus granarius*, Curtis; *Bruchus rufimanus*, Boh." Professor Riley, in the *American Entomologist*, ii, 1870, and in his Third Missouri Report, 1871, gives it place as *B. granarius*; in the Index to his writings in the *Bibliography of American Economic Entomology*, Pts. i-iii, 1890, which passed under his revision, no correction of synonymy is attached to the reference to *granarius*.

To solve the existing confusion and doubt, appeal was made to Miss Ormerod for aid, requesting her to tell me what their bean-weevil really was, and to send me examples that they might be compared with the "*rufimanus* Schön." of the Horn Monograph. In explanation of the apparent discrepancy in her reports, the following statement was made :

The *Bruchus* consideration is a very involved one. In the first edition of my *Manual* I was not aware of this, and accordingly took Curtis' description as being (as he gives it) of the *Bruchus granarius* Linn. Since then I became aware of the difficulty, and have tried to meet it in my second edition by giving *B. granarius* as of Curtis, with the now accepted specific name of *B. rufimanus* Boh.

I venture to quote still further from Miss Ormerod's letter, as showing additional synonymy, and the confusion existing in the names of the European species.

You will prefer to have our English views on this subject from a more authoritative Coleopterist than myself, so I venture to lay before you some information sent me in reply to my inquiries, by Mr. Oliver E. Janson — who I always find most trustworthy in running up specialisms which I have not all the works on, nor yet the access to specimens, which he can command. Mr. Janson wrote me:

"You are quite correct in your supposition regarding the *Bruchus granarius* of Curtis: it is the same as that now known under the name of *rufimanus* Boh. It was in error that Curtis, Stephens, and Marsham, identified our British species as the *granarius* of Linn."

* * * * *

I see that SHARP'S Catalogue gives only *rufimanus* Boh., without synonymy. WATERHOUSE catalogues *rufimanus* Schön., as *granarius* of Marsham and Stephens; and further, *seminarius* Linn., as the *granarius* of Payk., Oliv., Germ., Schönh., but not Linn. RYE gives nothing of *granarius* in his list of British Beetles, but has *rufimanus* Schön. PASCOE has *rufimanus* Boh. COX, in his Handbook, has *rufimanus* Boh.

* * * * *

Regarding the question of priority or superior claims of Schönherr or Boheman to the name *rufimanus*, I found that many of the descriptions in Schönherr's *Gen. et Spec. Curcul.*, were written by Boheman, and the description of *B. rufimanus*, is one of these.

To present the above in a somewhat clearer form, and incorporating some additional notes from Dr. Hamilton — too extended to present in full, it appears that —

Bruchus granarius of Curtis, Stephens, and Marsham, is *B. rufimanus* of Schönherr and Boheman—the first-named (Schön.) given priority in most of the European catalogues.

Bruchus granarius Linn. is *B. atomarius* Linn.—not British.

Bruchus granarius Fahr. is *B. seminarius* Linn. and is British.

Bruchus granarius Payk., Oliv., Germ., and Schön., is *B. seminarius* Linn.

Bruchus flavimanus Bohem. is *B. affinis* Froelich, found in Germany, France, Italy, and Caucassia; occurring also in Britain (auct. Hamilton).

Authenticated Examples Received from Europe.

Miss Ormerod kindly sent me several examples of their *Bruchus rufimanus* Boheman, received from Mr. Janson. Later, fearing that each and every specimen had not been given critical examination, and that, in their unmounted condition they may have been rubbed in transit, Mr. Janson most kindly forwarded to me through Miss Ormerod other examples beautifully displayed on cardboard, and retaining their pubescence and markings quite in contrast with the condition in which it is ordinarily found.

Referring to Dr. Horn's description of *B. rufimanus* in his "Revision" cited, Mr. Janson, in his letter accompanying the specimens, wrote:

I find the description of *rufimanus* to agree very well with our specimens except as regards the piceous color of the anterior tarsi and tip of the tibia; he also says that the hind tibiæ are sub-truncate, with the inner spine not prolonged, whilst in our *rufimanus* it is the outer spine that is not prolonged, the inner one being unusually long and acute. This would of course be an important difference, but I am inclined to think it a slip on the part of Dr. Horn, for I would be rather surprised if they really prove to be distinct species.

Dr. Hamilton has written me of the European specimens:

They agree very well with the figure given in Wood's *Insects at Home*, and with his letter press; also with the synopsis and description of F. Baudi (Monograph, 1883). I am not quite satisfied, however, that it is the true *rufimanus* of Schönherr.

It will be seen from the above that the synonymy of *Bruchus rufimanus* is not entirely settled, and that there still remains some work to be done upon it by those who have a special fondness for unraveling perplexing synonyms. But we now know the insect that is accepted by the best European authorities, as *rufimanus*, and in that, the more important consideration has been attained.

Distribution.

According to Baudi, the species ranges throughout Central and Southern Europe, Syria, Egypt, and all of Northern Africa, and also occurs in Montevideo, South America.

Remedies.

The remedies for it would be the same as for the preceding species. In addition to those, a very simple one is mentioned in Miss Ormerod's 12th Report, viz.: "In experimenting on infested beans, I found that if placed for a short time to soak [in cold water presumably], the water passed through the thin film of coating of the bean at the end of the gallery, and soddened the powdery dust and rubbish within, and thus choked the breathing pores of the beetle lying within, and killed it." If this will accomplish the purpose, it will be decidedly preferable to the risk of the hot-water application.

Bruchus lentis Boheman.*The Lentil Weevil.*

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

Bruchus lentis BOHEMAN: in Schoenherr's Gen. et Spec. Curculionidum, i, 1833, p. 70.

Bruchus lentis Koyi. DEJEAN: Cat. Coléop. Coll. Comte Dejean., Edit. III, 1837, p. 254 (hab. in Italy).

Bruchus lentis Koy. Schh. GAUBIL: Cat. Syn. Coléop. d'Eur. et d'Alg., 1849, p. 175.

Bruchus rufimanus Sch. HORN: in Trans. Am. Ent. Soc., iv, 1873, p. 315 (description).

Mylabris rufimanus Sch. REINECKE-ZESCH: List Coleop. Vicin. Buff., 1880, p. 10.

Bruchus lentis: BAUDI: in Deutsche Entomologische Zeitschrift, xxx, 1886, Heft ii, p. 395.

Bruchus lentis Koyi. RITZEMA BOS: Tierische Schädlinge und Nutzlinge, 1891, p. 294 f. 163.

Observed at Buffalo, N. Y.

This species of weevil is an European insect which, so far as known, has only occurred within the United States, at Buffalo, N. Y., where it was taken abundantly in a provision store. It has since been learned that lentils (*Lens esculenta*),* the food-plant of the insect, were kept for sale in the store, but whether they were imported from Europe is not known; they are not grown in the vicinity of Buffalo. From the number obtained, Mr. Reinecke made free distribution through his exchanges, under the name of *B. rufimanus* to which, from its general resemblance to that species, or difference from *B. obsoletus*, he referred it.† During the recent study given to the European bean-weevil, which, through the aid of our English friends, has resulted in its positive identification on this side of the Atlantic, and an understanding of its confused synonymy, it became evident that the Buffalo

*So recorded in Gray's *School and Field-Book of Botany*. 1869 (page 111), and in Wood's *New American Botanist and Florist*, 1889, part iv, page 100: the *Errum lens* or *Vicia lens* of many botanists.

† Of four of the examples sent to Dr. Hamilton under this name, two proved to be the lentil species and the others the common *Bruchus minus* Say.

specimens were quite different in features, and even belonged to another group from that of *rufimanus*, viz., to that of *pisorum*. In all probability, examples of it had served Dr. Horn for his description of *B. rufimanus*, in his Monograph of the Genus, and accordingly, a specimen submitted to him was referred to that species, as possibly a climatic variety, in consideration of some differences to which his attention was called.

Compared with *B. rufimanus*.

The principal points of difference, by the aid of which *B. lentis* is readily separable from *B. rufimanus*, have been succinctly noted in a letter from Dr. Hamilton; they are these:

1. In the eyes. In the European insect [*rufimanus*], besides the emargination, there is on the upper or inner side an inscribed line that nearly separates the lobe in two parts; in the Buffalo insect no such line exists or it is merely traceable.
2. The very obvious differences in the form of the thorax — the American short and transverse, the European longer and narrowed anteriorly.
3. The tooth at the side of the thorax in both sexes of the American; that of the European (sexes not observed) can scarcely be called a tooth, but is rather an undulation in the side of the thorax. (The purpose of this unevenness in the thoracic margin, whether tooth or undulation, is for the reception of the femoro-tibial articulation of the anterior legs while the insect is in the seed.)
4. The tooth of the posterior femur in the American seems acute, as in *pisorum*, while in the other it is rather a lamination. (The examination was made with a lens; the insects should have been relaxed and then observed under a microscope. This, of itself if sustained, would alone be specific.)
5. There is a row on each side of the ventral segments of dense cinereous pubescence in the American — not observed in the others.
6. Part of the middle legs of the American is rufous, but color would not be specific.
7. The general sculpture of the European is much coarser; the striae of the elytra are deeper, the intervals wider, and the transverse rugae are wider.
8. The American form is one-half smaller (this alone would not be specific).

Identified in Europe.

As it seemed probable that the insect was an introduction from Europe, an example was sent, through Miss Ormerod to Mr. O. E. Janson, of London, for comparison with European forms. The following very satisfactory answer, giving the result of the critical comparisons, was returned:

Not being able satisfactorily to identify the *Bruchus*, I forwarded it to my friend Dr. Sharp, who has quite recently worked at the group and published a monograph of the Central American species. He writes me that he thinks that there can be no doubt that it is the *Bruchus lentis* Bohem., and that he can see no difference between the specimen and European examples. Upon comparing it myself with Boheman's description, I found that it possessed denticles at the sides of the thorax, which Boheman says do not exist in *lentis*. I therefore pointed this out to Dr. Sharp, and he writes me in reply:

"Baudi, the best and the most recent writer on the genus, places *lentis* in the division with denticulate sides to the thorax. c. f. *Deutsche Ent. Zeit.*, vol. xxx, specimens so named by Kraatz when he worked out the genus and others named by Schaum, Wolliston, etc., have the denticle."

Description.

Perhaps the best published description of *B. lentis* is that given by F. Baudi (above quoted) in his recent Monograph of the Bruchidæ. As the work in which it is published is inaccessible to most students, and the original might not be of service to all if attainable, Dr. Hamilton has kindly supplied the following translation from the Latin, contained in *Deutsche Entomologische Zeitschrift*, xxx, 1886, Heft ii, p. 395.

BRUCHUS LENTIS Boh.

Conspectus.—Thorax with a tooth on each side, behind which it is more or less emarginate * * * Posterior femora armed with a more or less strong tooth before the apex * * * Thorax armed at the middle with an inconspicuous tooth * * * Anterior feet testaceous, simple in both sexes; * * * Anterior feet of the male nearly always testaceous; of the female with the femora black at base * * * The intermediate feet black, with the tibiæ and tarsi rufous.

Description.—Oblong-ovate, black, with grayish-brown or ochraceous pubescence; thorax nearly truncate at apex, obsoletely dentate on each side at middle and scarcely emarginate behind the tooth; elytra ornamented with longitudinal, narrow, whitish lines, alternating with brownish spots often confusedly, there being larger brownish spots near the base on the thorax, and also on the base of the elytra; pygidium pubescent with cinereous or fulvescence, broadly infusate on each side near apex, and occasionally almost uniformly fulvo-pubescent; three white spots at base, or rarely wholly griseo-pubescent; antennæ nearly as long as the head and thorax, suddenly thickened after the third joint and more gradually so to apex, black, first five joints rufo-testaceous; the anterior feet are rufo-testaceous, the femora in the female are frequently infusate at base, the middle have the femora black, occasionally rufous at the knees, tibiæ and tarsi rufo-testaceous; the posterior femora armed with a medium sized acute tooth.

Male—Middle tibiæ slightly areolate, armed at the apex with a very fine black spine; the fifth ventral segment perceptibly emarginate at the middle of the hind border.

Hab. Central and Southern Europe, Syria; Italy, most frequently in lentils. Varies by both sexes having rarely the femora of the anterior feet black or piceous. Southern France.

Its Economic Importance.

Having received this insect only from Buffalo, N. Y., we do not know of its having become established in the United States. Its economic importance, however, could not be of particular moment, as lentils are not grown to any great extent in this country, but are in the main imported by a half-dozen or more large wholesale dealers in New York city. From one of these an Albany house procures its supply for the Albany market, which usually amounts to about fifty bags annually, of one hundred and fifty pounds each.* Their sale is limited to the German population, who use it prepared as a soup and also as a vegetable eaten with vinegar.

According to Mr. Daniel Batchelor, of Utica, N. Y., lentils are rarely grown in England as the climate is too moist for the seed to mature

* This dealer informs me that when his stock has been kept over the winter, it is often pierced with small holes by a worm, which, from his description, should be the lentil weevil.

without moulding. They are extensively grown in the south of Europe. French catalogues advertise *lentillon de printemps* and *lentillon d'hiver*, and in German catalogues they are designated as the large, and the small, lentil.

Mr. J. Fletcher, Entomologist of the Dominion of Canada, informs me: "The lentil is not grown as a crop in Canada. Two or three varieties are raised in small quantities at the Hungarian and the Bohemian settlements north of Whitewood in our Northwest Territories, but the seed is not quoted in any of our seed catalogues, which is a good criterion as to the demand. Experiments in cultivating lentils in this district a few years ago were a failure, as the crop obtained did not prove remunerative."*

The imported lentil, *Lens esculenta*, as found in the Albany market, is a small, yellowish or brownish seed, flattened to the shape of a double-convex lens, averaging less than one-fourth of an inch in diameter and with a maximum thickness of one-eighth of an inch; it grows in a small, broad, two-seeded pod. The seed would seem almost too small to contain the *Bruchus lentis*, as its shortest diameter is less than the length of the weevil. But this seeming difficulty is obviated by the position of the pupal cell of the *Bruchus*, which is always inclined to the surface of the seed, as may be seen in the bean-weevil, so that the beetle, lying within its cell, may give to its beak the sweep required for cutting the circular lid for its escape.

Possibly the "large lentil" of the German catalogues is the one used for feeding to animals in Europe, and not imported here, and the variety more liable to *Bruchus* attack. Baudi, in his description of the insect, does not give the scientific name of the lentil, but merely states — "frequens in lente."

Conotrachelus nenuphar (Herbst).

The Plum Curculio.

(Ord. COLEOPTERA: Fam. CURCULIONIDÆ.)

Curculio nenuphar. HERBST: *Natursyst. bekann. in- und auslând. Insecten*, vii, 1797, p. 29.

Conotrachelus nenuphar. HARRIS: *Ins. New Engl.*, 1852, pp. 65-71; *Ins. Inj. Veg.*, 1862, pp. 75-82, figs. 39, 40.

Conotrachelus nenuphar. WALSH: in *Practical Entomologist*, ii, 1867, pp. 75-79 (natural history and remedies).—RILEY: *1st Rept. Ins. Mo.*, 1869, pp. 50-62 (nat. hist. rem., &c.)—SAUNDERS: *Insects Injurious to Fruits*, 1883 and 1889, pp. 180-187, figs. 192-200 (nat. hist., rem., nat. enemies, &c.)—RILEY-HOWARD: in *Rept. Commis. Agricul. for 1888*, pp. 57-79, plate I and XII.

* I have since learned, through Professor E. S. Goff, of Madison, Wisconsin, that lentils, in two kinds, are grown as a market crop, in Manitowee county, Wisc., and more extensively in Kewaunee county. They are a good crop and sell, at present, at \$2.25 per 60 lbs. They are not infested with the weevil.

This notorious pest of the fruit-grower, represented in Figure 19, has not been noticed at any length in these reports. In the admirable series of fourteen annual reports by Dr. Fitch, my predecessor, in which are given extended accounts of the larger number of our more injurious insect enemies, it was simply named and characterized among the insects infesting the plum tree—the reader being referred, for further information upon it, to the writings of Dr. Harris. It has, however, been so frequently written of and figured in agricultural journals, and discussed in the meetings of farmers' clubs and horticultural societies, that the present reference to it is simply for the purpose of noticing

and putting in the hands of the fruit-growers of New York the two best measures, so far as known, for its control. Above are noted a few of the principal publications relating to the insect, which will give all needed information of its life-history, habits, food-plants, etc., to those who may desire the knowledge. The last named publication, by Dr. Riley and Mr. L. O. Howard, is quite full, covering not only all that is of special moment in the other writings named, but about all that is known of the insect and of the best approved methods of dealing with it, up to the present time. It treats at length of the geographical distribution of the species, its food-plants, habits and natural history (four pages), its natural enemies, remedies (twelve pages), and experiments in rearing the insect. This valuable paper forms a portion of Dr. Riley's Entomological Report for the year 1888, and is contained in the Annual Report of the Department of Agriculture for that year. From the very large edition of this report annually printed by order of Congress, copies may doubtless be obtained, gratuitously, by making proper request of the Secretary of Agriculture, at Washington.

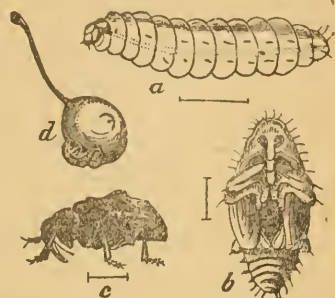


FIG. 19.—The plum curculio, *CONOTRACHELUS NENUPHAR*: *a*, the larva; *b*, the pupa; *c*, the beetle; *d*, a plum with the crescent cut.

The Remedies for Curculio Attack.

The remedies and preventives that have been recommended for this insect in the various writings upon it would aggregate several volumes. Among them, to cite a few, are the following: dusting the foliage with air-slaked lime; sprinkling with lime-wash; jarring the beetles from the tree; trapping by chips or pieces of wood or bark distributed beneath the tree; attracting to bottles of sweetened water hung among the branches; repelling by strongly odorous substances placed

in the tree; repelling by burning gas-tar; spraying with coal-tar water; spraying with whale-oil soap solution; inclosing pigs and poultry in the orchard to feed upon the fallen infested fruit; planting the trees over ponds or water-courses; paving or flagging beneath the trees, and poisoning the beetles with arsenic.

Of the above, while some of them would undoubtedly serve as palliatives of attack, only two are now regarded as reliable for the protection of an exposed crop: these are, jarring the insects from the trees, and spraying with an arsenical mixture.

Arsenical Spraying.

The last named method has but recently been brought into notice, but the success that has attended the experiments made, has shown conclusively that when properly done, a good crop of plums may be insured (so far as it may depend upon exemption from *curculio* injury) at a moderate cost and with comparatively little labor. The value of this method is based largely upon the fact which has been lately discovered, that the beetle feeds to a considerable extent on the foliage of the plum tree as well as on the fruit, and is therefore exposed to the poison of which it partakes with its food.

A spraying "properly done," implies a knowledge of, and attention to, a suitable apparatus, the strength of the arsenical mixture, its uniform strength while being distributed, and the time or times that will give the best results. The comparative merits of Paris green and London purple are also to be considered.

All of these points are referred to in a communication made by me to the *Country Gentleman* of April 24th, in reply to an inquiry of the best time for spraying the different fruit trees (including the apricot) and the strength of the "London purple" mixture required for protection from *curculio* attack; it is essentially given below:

When to Spray.

"The spraying should be done just as soon as the blossoms fall. Although it would be effective (and therefore desirable) earlier than this, or upon the first appearance of the *curculio* abroad and its feeding on the young leaves, there is a strong opposition to the application of arsenical poisons to fruit blossoms, for fear of its killing the honey bees that visit them."

It is by no means certain, however, that bees would be poisoned by this means. I do not know of any positive evidence that they have thus been killed, and I question the general statements made of its having occurred. In consideration of the importance of early spraying—in advance, and during the time, of blossoming—for several of our insect pests, it would be well, before we continue to put this limi-

tation upon the proper time for arsenical spraying, that the danger to bees from visiting the blossoms should be positively determined. The possibility of their being poisoned in this manner, or collecting poison that may be communicated to the honey, is questioned by some of our best botanists. Will not some of our Agricultural Experiment Stations make a study in this direction the coming season?

London Purple, or Paris Green?

"The seasonal conditions of last year [1889] were such that the foliage was badly affected in many instances after having been sprayed with London purple. Although most of the injury observed was doubtless chargeable upon one or more of the fungous diseases that were unusually prevalent, it is at the same time possible that the foliage was more susceptible to injury from London purple than in ordinary years.

"After the experience of last year several of our fruit-growers, who have been in the habit of using the purple, will, the present year, abandon it for Paris green. Whenever this arsenite is used care should be taken that the liquid be kept in continual agitation, so as not to permit it to become of unequal strength through its speedy settling. The purple is much more easily held in suspension, being a lighter powder.

"In favor of London purple, it may be stated that Entomologist Weed of the Ohio Agricultural Experiment Station, has used, without injury to the foliage, one pound of the purple to one hundred gallons of water, in protecting cherry trees from curculio attack, saving thereby 75 per cent of the fruit liable to injury. The same result was obtained by spraying two or three times with the weaker mixture of one pound to one hundred and sixty gallons of water.

"Although methods of spraying are not yet perfected, and each season's experiments are giving us important information regarding it, the success attending it at the present is so marked and so great that no fruit-grower can afford to dispense with arsenical spraying."

Strength of Mixture.

Replying to the question, how strong a mixture should be used: "One pound of Paris green to two hundred gallons of water may safely be used on apple and cherry trees; one pound to two hundred and fifty gallons for the pear and plum, which are more sensitive, and one pound to three hundred gallons for the apricot, presuming it (in the absence of any direct experiments) to be almost as readily affected as the peach.

"If experiments shall satisfactorily prove that our fruit trees will, in general, bear a stronger liquid than the above—in this event, for

killing the *curculio*, it should be used as strong as the foliage will bear, as in this case, we have to poison the adult insect. For preventing *codling-moth* injury, one pound of Paris green to two hundred and fifty or two hundred and sixty gallons of water has proved sufficient, as an almost infinitesimal quantity of the arsenite will kill the young caterpillar just as it is hatched from the egg. In spraying for the *curculio*, it should be repeated for two or three times at intervals of ten days (or if rain intervenes, then after every rain), as the *curculio* continues its egg-laying and feeding on the fruit for a longer time than the duration of the flight of the *codling-moth*."

How to Mix Paris green.

Another correspondent, from Penn Yan, N. Y., submits the following: "I would like information with regard to mixing Paris green in spraying operations. Will the pumps that discharge a part of the liquid in the tanks mix it effectually, or in what way can it be done?" Answer was made through the *Country Gentleman*, for May 1, 1890, as follows:

"Paris green mixes readily with water, and only needs to be stirred into it, or to have the water poured upon it and then stirred. The spraying pumps that are furnished with a return hose for dis-



FIG. 20. — The Field Force Pump Co's
"Perfection Spraying Outfit."



FIG. 21. — The Goulds' Manufacturing
Co's Double-Acting Spraying Pump.

charging into the barrel or tank at its bottom — such as are sold by the Field Force Pump Company (their "perfection spraying outfit;" see Figure 20), by the Goulds' Manufacturing Company (Figure 21), and I presume by other manufacturers — keep the mixture sufficiently and properly stirred. Indeed it is difficult by any other known method to maintain a proper diffusion of the Paris green throughout the

water. Constant agitation is very important in using this arsenite — far more so than with the lighter powder of London purple. From an experiment just made by me, it was found that a mixture of one pound of the Paris green uniformly distributed by stirring in two hundred gallons of water and then permitted to rest, would in thirty seconds give a mixture drawn from the bottom through the spraying pipe of a strength of about one pound to sixty gallons of water — far too strong for most foliage. London purple should first be mixed with a little water into a paste-like consistency, and then washed through a fine wire sieve into the tank that such impurities may be removed as might otherwise clog the finer spraying nozzles.”

In using smaller pumps, such as may be placed in a pail or open vessel, as the Combination Force Pump of P. C. Lewis, Catskill, N. Y.,

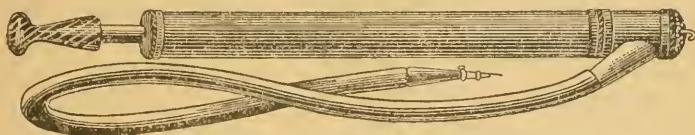


FIG. 22.— The Lewis Combination Force Pump, in one of its forms.

one of the forms of which is shown in Figure 22, the required mixture of the Paris green may be accomplished by withdrawing the hose from the tree at short intervals, and directing its nozzle into the vessel for two or three seconds while the pumping is continued.

Beneficial Results of Spraying.

As illustrating the benefits resulting from arsenical spraying for prevention of curculio injury, we may refer to the experiments made by Dr. Otto Lugger, Entomologist of the Minnesota Agricultural Experiment Station, in spraying native plums, which are often spoken of as being curculio proof.*

The first work of the curculio was noticed on June 4th; on the next day two trees each, of from ten to twelve feet in height, of three different varieties, were sprayed by the aid of a common garden syringe with one spoonful of London purple to two gallons of water, just after the blossoms had fallen, and twice thereafter at intervals of a week.

As the result, the ripe fruit on the sprayed trees was almost entirely free from blemishes, was of unusually large size, well colored and of high flavor. The unsprayed trees used as checks, contained hardly a plum that was not injured by the curculio or by the plum-gouger, while the fruit ripened prematurely and was of smaller size and inferior flavor. The foliage of the syringed trees was uninjured.

* Bulletin No. 10, March, 1890, Minnesota Agricultural Experiment Station.

Jarring for the Plum Curculio.

Some of our orchardists and fruit-growers' still find it profitable, even in connection with spraying, to collect the curculio by jarring from the trees. Mr. J. M. Randall, of Dey's Landing, Seneca county, N. Y., has written to me as follows, under date of May 23d, of his crusade against the insect :

We have been fighting the plum curculio since the 18th of this month. We found none the day before, but on that morning, following a warm night, killed one hundred and thirteen. The next morning we killed forty-nine, and the following morning the same number. Rain fell on the 20th, and since the 21st we have caught none, owing to the wet weather. The above record is for an orchard of 525 four-year-old plum trees, which is surrounded on the north and south by apple orchards, on the east by quinces, and on the west by a vineyard. We catch more of the curculios next to the apple orchards and down through the middle of the plum orchard. More are found when the nights are warm and with an east wind.

Although the best method of jarring for the curculio has often been published in our agricultural journals, it may be well to give it here :

Rod iron of about three-eighths of an inch in diameter, is cut in pieces three inches long. With a brace-bit of the same diameter bore a hole of an inch and a half in depth, at convenient reach, in each of the principal limbs of the tree (if it be a large one) and drive in the iron. A sharp blow with a hammer upon the head of the iron, which should be flat, will at once bring all the curculios down upon the sheet spread for them beneath, or upon the curculio-catcher held in the hand, if one has been prepared.

An excellent apparatus for the purpose, convenient for orchards of moderate size, is the following: Take a square of two yards white muslin, or if a larger size is needed for larger trees, make a piece by



FIG. 23 — CURCULIO-CATCHER.

sewing together two by three yards, or larger. Stiffen it with light rods across the ends, and with one rod at the middle to keep them apart and to serve as a handle, as shown in the figure. Let it be a little slack, so as to give a slightly concave form to the sheet. Iron plugs having previously been inserted in the tree, or into each main branch, the operator holds this sheet in his left hand under one side of the tree, and strikes the plug with a heavy hammer in his right hand. The curculios caught upon the sheet may be turned into a pan of

water and kerosene. Oil-cloth might be substituted for the muslin, as it would not wet with the dew when used in the morning, and as affording a smoother rolling surface for the beetles. (*Country Gentleman*, xlii, 1881, p. 259.)

Oviposition of the Plum Curculio.

So apt are we to accept as truth statements apparently made of the result of personal observation, that for a long time the egg-laying of the curculio was believed to be after the manner described by Dr. Harris, viz.: that the beetle first makes a small crescent-shaped incision with its snout in the skin of the plum, and then turning round inserts an egg into the wound.

Dr. Fitch has apparently copied from Dr. Harris when he represents the beetle as "making a small crescent-shaped incision upon the side of the young fruit and dropping an egg therein." (*First Rept. Ins. New York*, 1856, p. 47.)

Mr. Walsh, in 1867, entertained the belief that the egg was deposited within the crescent cut. He has described the attendant operations as follows: "Alighting upon a plum, she then, with the minute jaws placed at the tip of her snout, proceeds to make the singular crescent-shaped slit in the skin of the fruit, which is characteristic of the species, and to which the popular name of "little Turk" refers. In this slit she excavates with the same instruments a hole such as a pin would make, to as great a depth as the length of her snout will allow, widening and enlarging it a little at the bottom so as to make it somewhat gourd-shaped. Depositing in the slit a single egg, she next proceeds to crowd it down with her snout to the bottom of the hole where the cavity is sufficiently large enough to avoid all danger of the flesh of the injured plum growing in upon and crushing the egg." (*Practical Entomologist*, ii, 1867, p. 76.)

The true method of oviposition was first pointed out by Professor Riley in his *First Report on the Insects of Missouri*, in 1869. The egg is not deposited within the crescent. The beetle first makes a cut with her jaws through the skin of the fruit; she then inserts her curved beak beneath the skin, making a hole sufficiently large to receive the egg which is then dropped at the mouth of the opening. Turning around and using her beak, the egg is crowded to the end of the hole. This being done, the crescent cut is next made in front of the egg, undermining it and leaving it in a sort of flap.

In confirmation of the above, the same method of oviposition coupled with a somewhat more delicate manipulation, has been described to me in a communication from Mr. T. E. Hayward, of

Pittsford, N. Y., as having been observed by him on different occasions.

After selecting a spot, the beetle very carefully turns up a thin piece of skin exposing a place of the size of the thickness of an ordinary pin. It then with its beak makes a hole for the reception of the egg, which is deposited and carefully arranged therein. The bit of skin is then turned down over it and worked at until it is accurately fitted and seemingly air-tight. The semicircular or crescent cut is then made near it for the purpose of checking the growth of the skin so that the egg may not be disturbed by the future growth. The general opinion, I know, is that the crescent cut is first made and the egg placed underneath it — a small mistake, but how it detracts from the instinctive skill displayed in the more elaborate operation above given. I have never timed a beetle in its act of oviposition, but I judge that it occupies from fifteen to twenty minutes in laying a single egg.

That our correspondent has correctly described as an "elaborate operation," the preparation of the hole for the reception of the egg and its closure after oviposition, would seem to find support in the statement of Riley and Howard that "the first cutting of the cylindrical hole occupied *five minutes*," while all the subsequent procedure — the deposit of the egg, its packing in, and the cutting of the crescent required only from five to eight minutes of time.

Cicada septendecim Linn.

The Periodical Cicada.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. CICADIDÆ.)

WALSH-RILEY: in Amer. Entomol., i, 1869, pp. 63-72, figs. 58-64 (broods designated, a 13-year for n, etc.).

CHAMBERS: in Amer. Entomol., iii, 1880, p. 77 (occurrence in Colorado in 1876).

UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 227, f. 304, pupa (nat. hist. and distribution).

DAVIS: in Entomolog. Amer., i, 1885, p. 91 (on Long Island).

RILEY: in Harper's Magazine, for June 6, 1885, xxix, p. 363 (of broods vii and xxii); in Science, for June 25, 1885, v, pp. 518-521 (food, transf., voice, etc.); Bull. No. 8, Divis. of Ent.—Dept. Agricul., 1885, 46 pp., 8 figs. (general account); in Rept. Commis. Agricul. for 1885, pp. 233-258, plates i and iv, f. 1, pl. 6 (general account); in Entomolog. Amer., 1885, p. 91 (transfer of eggs, north and south).

LINTNER: 2d Rept. Ins. N. Y., 1885, pp. 167-179, figs. 43-47 (general account); 5th Rept. do., 1889, p. 276 (experiment with); in Albany Morning Express, for June 13, 1890, p. 2, c. 5 (occurrence at Tivoli, N. Y.).

HOWARD: in Proc. Ent. Soc. Wash., i, 1885, p. 29 (edibility of).

BUTLER: in Bull. No. 12, Divis. of Ent.—Dept. Agricul., 1886, pp. 24-31 (occurrences in S. E. Indiana, habits, nat. enemies, etc.).

SCHWARZ: in Proc. Ent. Soc. Wash., i, 1886, p. 52 (voice of, at Fortress Monroe, and of what brood?)

RILEY-HOWARD: in *Insect Life*, i, 1888, p. 31 (of broods v and x in 1888), p. 298 (distribution of brood viii in 1889), p. 324 (precursors of brood viii).

McNEAL: in *Insect Life*, i, 1888, p. 50 (precursors in 1888 of brood v).

MURTFELDT: in *Rept. Commis. Agricul. for 1888*, p. 135 (trees killed in Illinois).

BARLOW: in *Insect Life*, ii, 1889, p. 342 (larva in its gallery).

MARCH: in *Rept. Commis. Agricul. for 1889*, p. 218 (food, injuries, enemies).

WEBSTER: in *Insect Life*, ii, 1889, p. 161 (brood ?viii in the 17th century).

SCHWARZ: in *Proc. Ent. Soc. Wash.*, 1889, pp. 230, 248 (of brood viii near Washington).

(The above are additional to the references given in the 2d *Rept. Ins. N. Y.*, 1883.)

The regular appearance of the successive broods of this remarkable insect at the long intervals of seventeen years—the longest life-period of any known species—has been fully established, and the limits of the twenty-two broods that occur throughout the United States have been approximately ascertained and mapped.* Of these, six only



FIG. 24.—The seventeen-year Cicada—*CICADA SEPTENDECIM*: a, the pupa; b, the pupa case; c, the mature insect.

are recognized as occupying some part of the territory of the State of New York. The years of their appearance are so well known to entomologists, and by them usually announced in advance through the public press, that the event is always looked forward to with no little interest.

The Periodical Cicada at Tivoli, N. Y., in 1890.

The present year, 1890, is not one of the New York "cicada years." When, therefore, the announcement was made of the appearance of the insect at a locality on the Hudson river, where it was not due until 1894, it could hardly be credited, and it was naturally questioned if some other species had not been mistaken for it, notwithstanding the authoritative source from which the information came.

Mr. Frederick Clarkson, of New York city, wrote me on June 7th, from Tivoli-on-Hudson, that he had that day captured on the piazza

of the place formerly known as "Clermont," the residence of Chancellor Livingston, examples, in both sexes, of *Cicada septendecim*, and that at the time of writing (noon) the hum of the insects was quite loud. He had also taken the puparia from the trunks of trees.

That I might personally verify the occurrence of the insect, procure some specimens, and note its abundance, I visited Tivoli on June 11th. A search within the woods near the station gave no indication of its presence, either to the eye or ear. Driving to Clermont, three miles distant, I was equally unsuccessful in finding the insect. Mr. Clarkson, to my regret, had returned to New York, and taken his captures with him. The heavy rain that was falling prevented any extended search through the grounds and adjoining woods, and had silenced the cicada's song. Mr. Clermont Livingston, the present owner and occupant of the manor, kindly gave me all the information in his power in relation to the visitation. He had heard the song during the morning before my arrival, as also on several preceding days, during the warmer and brighter hours—the louder when the sun was shining brightly at mid-day, when there was a continual hum. He recognized it as the same in character with that which had attended the appearance in 1860 and 1877 of the "Hudson river brood." Not, however, expecting the recurrence of the brood until 1894—when the notes were first heard, some days before Mr. Clarkson's coming, he had ascribed them to tree-toads.

A few days later Mr. Clarkson again visited the Livingston manor, but was unable to find any more examples. Those that he had taken had become injured and were thrown away, having already many in his cabinet which he had obtained in 1877 at the same locality. Under date of June 17th he wrote :

I did not succeed in obtaining either the imago, larva, or puparium, and am therefore led to believe that the insects are not numerous; but that a few are in this neighborhood is conclusive from the fact that their music was heard on every clear warm day during my visit, which—with the interruption of a few days—extended from the 3d to the 16th inst. The capture of a male and female made by me on the piazza of the residence referred to, on the 4th inst., the day after my arrival, and which I greatly regret I did not keep, fully believing at that time that I could supply any number if desired, I have no hesitation in saying are identical with those taken by me on the upper portion of the same manor at "Oak Hill" in 1877, and which, in their various stages of development are represented in my cabinet; their marked characteristic being orange-red eyes, legs, and nerves of wings. The sound produced by the insects this year is well described by the

lettering as given by Dr. Fitch, and which is perfectly familiar to me through the experience of the visitations of 1860 and 1877, viz.
"tsh—e—e—E—E—E—e—e—ou."

Mr. Clarkson was inclined, at the first, to regard this as the advance guard of the host that is expected in 1894, and suggested as a possibility that the extraordinary wet of the past year may have caused an earlier development of such larvæ as may have been the more directly exposed to its influence.

The Insect Reported at Galway, N. Y.

By a strange coincidence, just before the discovery of the cicada at Tivoli, my attention was called to an item in the *Albany Evening Journal* to the following effect—I quote from memory, as the slip has been mislaid :

A farmer at Galway, while plowing in his field a day or two ago, turned up with his plow a mass of compacted earth filled with small holes. It excited his curiosity, and it was carried to his house and laid aside. A couple of days afterward when happening to look at it again, it was found to be swarming with seventeen-year locusts. It will be remembered that this is "locust year."

The above-named locality is in the south-western part of the county of Saratoga, and lies within the limits of the territory occupied by the "Hudson river brood" (the 1st as defined by Dr. Fitch, brood viii of Walsh-Riley, and brood xii of Riley), as does, also Tivoli, in Dutchess county.

The simultaneous appearance of the insect at these two localities, could have but one interpretation, viz., that they belonged to the brood above-mentioned, but which was not due until 1894. But in no recorded instance had any portion of a brood shown itself for more than one year in advance—never for two—while *three* would be entirely at variance with our knowledge of the insect's life-history.

Precursors of a Regular Brood.

Addressing an inquiry to Dr. Riley, who has made special study of the species, if he had knowledge of its occurrence for more than a year before its appointed time, and stating what I had learned of its appearance at Tivoli, the following reply was returned, under date of June 16th :

Yours of the 12th has just come. You will note from my account in Bulletin No. 8 of the Division (page 8) the statement that the Periodical Cicada frequently appears in small numbers, and more rarely in larger numbers, a year before or a year after its proper period. I know of no positive evidence (which it would, in fact, be difficult to obtain) of the appearance two years in advance, though I

can see no reason why there should not be even that amount of irregularity among straggling members of a brood, but the evidence would have to be quite strong to justify such conclusion. The specimens you refer to might perhaps be more justifiedly considered as retarded individuals of Brood VIII. I shall be glad to hear from you when you receive specimens.

P. S.—If they turn out to be true *septendecim*, I will give the matter more careful consideration in the light of other unpublished data, but I would like first positive evidence that we are not after a “will-o’-the-wisp,” from wrong identification.

The Tivoli Insects not Referable to Brood VIII.

Brood viii, above referred to, appeared in 1889. Its range is the extreme south-eastern part of Massachusetts, across Long Island, along the Atlantic coast to Chesapeake Bay, and up the Susquehanna as far as to Carlisle, in Pennsylvania.

As members of this brood have never been observed within the State of New York, except on Long Island, there would seem to be no reason for its consideration in connection with the Tivoli visitation. Tivoli is one hundred miles north of New York city, and above two hundred miles north-east of Carlisle, Pa.

Are they the Remnant of an Unrecorded Brood?

The letter from Mr. Clarkson, given above, having been submitted to Dr. Riley for perusal, the following response was made:

From Mr. Clarkson’s letter which you inclose, I think there can be no doubt that he has found this year the genuine *Cicada septendecim*, and his account seems to be confirmed by the reported appearance of the Cicada at Galway. I agree with you that the Tivoli Cicadae can not be referred to Brood VIII, and if they were numerous enough to be called a brood they would form one hitherto unrecorded. Referring to my unpublished Cicada records I find under the heading “New or doubtful broods,” a record of a seventeen-year brood 1839-’56, in Halifax Co., N. C. To be sure this record is a little doubtful since I obtained no further evidence in 1873 or in 1890, but, taken in connection with the appearance of specimens near Washington, D. C., in 1890, and with those reported by you, it is possible that we have to do with the scattered remnants of a formerly widely distributed and numerous brood. Two other records mention the appearance of Cicada in 1873, in Scott Co., Mo., Alexander Co., Ill. and Holmes Co., Miss. Finally, I have a report from reliable authority (the late Mr. W. S. Robertson) of a brood in 1839 at Muscogee, Indian Territory. But these western localities have not been corroborated subsequently and, moreover, we can not tell whether they belong to a 17 or 13 year brood.

It is safe to say that we know now pretty accurately all the large broods of the Periodical Cicada, but it is more than probable that in many places a few and scattered specimens will appear in off years which cannot be referred as precursors or belated specimens to any

of the established broods, and which can not properly be called a "Brood."

The "Galway Cicadæ," a Newspaper Story.

After many efforts made to ascertain the name of the "farmer in Galway," who had unearthed the cicada mass, a letter was received from the enterprising reporter who had communicated (in his own hand-writing, as was subsequently learned) the item to the *Albany Evening Journal*, expressing his regret that he was unable, after diligent inquiry, to trace the report to its source, and that "the first intimation that he had of the nest of locusts was what appeared in the *Journal*!"

This blots out the Galway appearance, and with it, forerunners of the Hudson river brood three years in advance of time.

An Undecided Question.

I have no opinion of my own, or even suggestion, to offer, as to the reference that should be made of the Tivoli cicadæ—whether to any of the unrecorded broods, or to one hitherto unrecognized. The possibilities have apparently been covered in the careful consideration and examination of records by Dr. Riley, and in the views advanced by Mr. Frederick Clarkson, in the portion of a letter given below. Future observations, or the discovery of overlooked records, may possibly enable us to reach a definite conclusion.

Is there a New York Thirteen-year Brood?

I thank you very kindly for your letter of June 30th, and return to you herewith the correspondence which you have permitted me the pleasure of reading. I shall be most happy to furnish you with any facts that may reach me with regard to this extraordinary visitation.

If the definition as given by Dr. Riley is strictly correct as to what constitutes a brood, then I think the conclusion which he has reached is a possible solution of this year's visitation, but in the absence of more essential data, it occurs to me that the captures made this year may be a thirteen-year brood, which may have occurred simultaneously with the extraordinary seventeen-year brood of 1877, and possibly formed a part, if not the whole, of the very limited number seen at Westchester by Mr. Angus in 1864. If it is satisfactorily established that the puparia discovered on Staten Island by Mr. Davis in 1881 was of the red-eyed Cicada, it would demonstrate the fact that in that year it was the seventeen-year brood, but does this admission, in view of present findings, exclude the conjecture that the thirteen and seventeen-year broods may have appeared together in 1864. Does it not rather look, in view of the fact that we have rather accurate knowledge of all the large broods, that these limited numbers may represent broods in the decadence, and becoming more and more exhausted at each periodical appearance? However, these are merely suggestions to doctors learned in the lore of the Cicadæ.

BRIEF NOTES ON VARIOUS INSECTS.

Ocneria dispar (Linn.).

The Gypsy Moth.

The Gypsy moth, which at the present time is exciting so much interest in Massachusetts, in efforts for its extermination, or at least



FIG. 25.—The male Gypsy moth,
OCNERIA DISPAR.

to prevent its spread, and to which further notice is given on page 335 is represented in Figures 25 and 26. These figures, copied from European authors, and reproduced from *Insect Life* for 1890, are stated to be of least one-fourth the largest American

or European examples that have come under my observation. The largest examples that have been reared by me, measure respectively in expanse of wings, 1.60 inch, and 2.25 inches.

While the insect is still confined to three or four townships in the eastern extremity of Massachusetts, and therefore at such a distance



FIG. 26.—The female Gypsy moth, *OCNERIA DISPAR.*

that in a natural distribution it would require many years ere it made its appearance in New York, still it is liable to be introduced in some of its stages, within our state at any time through railroad transportation. Attention is therefore invited to the

above figures of the moth, that it may be recognized, and promptly destroyed, in any locality where it might chance to be brought. The following communication, sent by me to the *Country Gentleman*, was the occasion of quoting me as not believing in, and as opposed to, the active measures which it was proposed, through the State aid solicited, to undertake against the insect for its extermination. It will be seen that such an inference could not properly be drawn from the communication.

EDS. COUNTRY GENTLEMAN.—My attention has been called to the following notice in the *New York World* of a recent issue, with the suggestion that an expression of my opinion upon it might be of interest:

[From the *New York World*.]

"Massachusetts farmers are filled with alarm over the reported ravages of a newly found insect pest which an Amherst College "bug sharp" says may become widespread through the country, and may cause more havoc than the celebrated Colorado potato beetle. This is the gypsy moth, known to entomologists as the *Ocneria dispar*. At present it is confined to the neighborhood of Medford, where it caused so much damage that Gov. Brackett, in his message the other day, saw fit to call the attention of agriculturists to the pest, and recommended its speedy extermination.

"The moth was introduced here twenty years ago by Dr. L. Trouvelot, who saw the eggs at the Paris Exposition, and put a few in his vest pocket. One day the little bunch of eggs was blown out of his window in Medford, and never heard from until last fall, when millions of the gypsy moths attacked shade and fruit trees and shrubbery, leaving nothing save stalks and twigs behind. The area thus devastated was an ellipse a mile and a half long, and half a mile wide.

"Prof. Fernald of the Amherst Agricultural College, says the moth is a terrible pest. The Harvard authority on bugs and millers, Professor Hagen, on the other hand, says his Amherst contemporary doesn't know what he is talking about. The Harvard expert asserts that the gypsy moth is not alarmingly destructive.

"'In my opinion,' says he, 'this talk about state aid, this ordering out the militia to shoot caterpillars, as it were, is entirely unnecessary. Let every man kill his own caterpillars.' The professor has some of them always on tap in his study."

The facts of the introduction into Medford, Mass., about twenty years ago of the gypsy moth, *Ocneria dispar*, and its subsequent multiplication and extension are, I believe, correctly given, but I doubt if, even in the limited area to which it is apparently confined, of "the trees and shrubbery" there were only left "the twigs and stalks." Nor do I believe that there is any danger, even if it shall become widespread, of its causing havoc even approximating to that of the Colorado potato beetle. I do not see any just cause for alarm on the part of farmers or others, over the introduction of this new pest. The caterpillar is "a general feeder"—represented as feeding, in Europe, "on every species of fruit and forest tree" (probably not absolutely true). But the general feeders, as a rule, are far less to be feared than those that concentrate their attack on a particular food-plant. This is also rather a local species. It is rarely injurious in England, and only occasionally so on the continent. It seems to prefer oak and other forest trees to fruit trees. Thus Professor Westwood has stated: "It

is occasionally exceedingly destructive in Germany to the forests, which they completely strip of their foliage."

While, therefore, there would seem to be no occasion for alarm, the insect is sufficiently injurious to move the people of Medford and the vicinity to prompt and energetic action to arrest its spread and exterminate it while in its present limited locality. It is believed that it can be done without severe labor or a large expenditure of money. How it may best be done has been pointed out in a special bulletin recently prepared by the able entomologist of the Massachusetts Agricultural College, Professor C. H. Fernald, and published by the Hatch Experiment Station, under date of November, 1889. This bulletin contains description and figure of the insect in its different stages, and narrates about all that is known of its appearance in this country, with directions how and when to fight it. Copies of it may probably be obtained by those interested by addressing the station at Amherst, Mass.—(*Country Gentleman*, of January 23, 1890.)

Several notices of this insect are contained in vols. ii and iii of *Insect Life*. In the former, pp. 208–211, may be found something of its European habits, the plants on which it is known to feed, and a list compiled by Mr. L. O. Howard, of twenty-four species of parasites which attack it. No detailed account of its observed habits and transformations in this country have been given us. Of a small colony reared by me on apple leaves in 1890, I have only the following memoranda: The first males emerged on July 26th and the last August 7th. The females were disclosed between August 1st and August 13th. From six larvæ, the pupation of which took place on July 13th and 14th, two males and four females appeared on August 1st, giving a pupal period of eighteen and nineteen days.

From other larvæ obtained in 1889, a male emerged a month earlier than the above, viz., on June 26th, and a female on July 17th.

Spilosoma Virginica (Fabr.).

The Yellow Woolly Bear.

I find a worm attacking my rhubarb, zinnias, calendulas, etc., on the under side of the leaf. It is from one inch to one inch and one-fourth in length, about one-eighth in diameter, and has long hairs on all sides of its body. Its color is a yellowish-white. It is easily captured, as it is slow in its movements, but is a rapid eater. It has eight feet on the under side of its body, about in the center; with these and with small points at the extremities it moves along.—[E. J. HUMES, Providence, R. I.]

Judging from the description given, the insect is the caterpillar of one of the "woolly bears" as they are commonly known from the long

hairs with which they are closely covered. This is doubtless the one that Dr. Harris has called the "yellow bear," as its hairs are usually of a pale yellow color, although in some examples they are brownish-yellow or a foxy-red. While most caterpillars have their particular food-plants, and some will feed only on a single species of plant, there are others to which hardly anything in our gardens comes amiss; of the latter kind is the "yellow bear," whose omnivorous habits and remarkable voracity renders it at times a great garden pest. When it has about reached its maximum size of two inches in length, it is

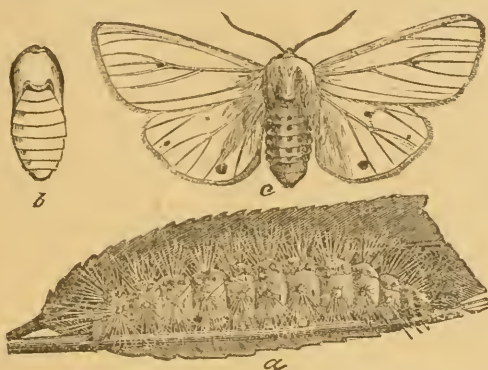


FIG. 27.—The caterpillar, pupa, and moth of *SPILSOMA VIRGINICA*.

capable of destroying a plant of moderate size in an incredibly short space of time. As the caterpillars do not feed in company and are generally not numerous in any locality, they can not be fought with the ordinary methods. Their presence is usually betrayed by the eaten foliage, when the caterpillar, conspicuous from its color and size can readily be found, removed from the plant and crushed. The moth into which it transforms has for its scientific name, *Spilosoma Virginia*. It is familiarly known as the "white miller," from its white wings, devoid of any marking except one, two, or three small black spots on each wing. Its body has a row of conspicuous black spots on its back, a similar one on each side, and a dark yellow line intermediately. The caterpillars now feeding (July 5th) will soon spin up into their cocoons, within which they will change to pupæ, from which the moths will emerge during the last of this month or beginning of August, and lay their eggs for another brood in clusters upon the leaves of various plants.

Figure 27 represents the insect in its three stages of larva, pupa, and imago. Saunders says that the eggs are round and yellow and are deposited on the under side of the leaves in large clusters, and in a few days hatch into small hairy caterpillars.

Thyridopteryx ephemeræformis Haw.*The Bag-Worm.*

The cases of this caterpillar which feeds on so large a number of our fruit, forest, and other trees (see 1st Rept. Ins. N. Y., p. 84), have been sent to me from Sargeantville, N. J., taken from quince trees by Mr. Anderson Bray, who reports them as occurring by hundreds on these trees.

The species is not recorded in "Saunders' Fruit Insects" among the pests of the quince, nor is it often noticed thereon. In the *American Entomologist*, i, 1869, p. 250, it is identified by Mr. Walsh, in examples received from Georgetown, O., and represented as literally stripping many of the quince trees in an orchard, although the larvæ were at the time but about one-third grown.

These records would seem to be sufficient to give it place among the insects affecting the quince—the list of which is as yet comparatively small compared with those that attack other fruits.

Erebus odora (Linn.).

In the *Fourth Report on the Insects of New York*, 1888, p. 138, a number of captures made of this comparatively rare Noctuid in the State of New York, are given. In addition to these, it may be recorded that a female, in fair condition, was taken at sugar, at Jamaica, L. I., on August 12, 1890, by Mr. J. V. D. Walker.

The time of appearance of this moth is extended over nearly one-half of the year—in June, August, September and November.

Tmetocera ocellana (Schiff.).*The Eye-Spotted Bud-moth.*

Inquiries are frequently received of a small caterpillar discovered on apple and other fruit trees, feeding among the opening leaves or burrowing into the green tips. It is of a dull-brown color, with its



FIG. 28. — The eye-spotted bud-moth, *TMETOCERA OCELLANA*, and its caterpillar.

head and front part of its body black, and bearing a few short scattering hairs. When full grown, it is about half an inch long. In its perfect state it is a small moth known as the *Tmetocera ocellana* or eye-spotted bud-moth, from the eye-like markings on the front wings and its feeding habit. It feeds on pear, cherry, and plum buds, as well as on those of the apple. The caterpillar may be found during early

May, boring into the base of the blossom buds, which it ties together

with its silken threads, and consumes one after another until only their blackened remains are left. Later in the month and extending into June, it spins together the young leaves and feeds upon them. It also bores into the blossom-bearing tips, eating the pith and causing their death. The moths usually appear abroad in July, although in rearing them I have had them emerge during the first week of June. Their eggs are deposited soon thereafter and the caterpillars come from them in about a week. This is the second brood, and as the leaves at this time are full-grown, their depredations are not serious, and have not attracted much attention. Large numbers of these caterpillars are sometimes found on a single tree, where their presence readily arrests attention, and their injuries become serious from the proportion of blossom buds destroyed. This pest is hardly known in the western states. The present season has presented conditions peculiarly favorable to their multiplication. The only way that promises success in their extermination is by spraying with Paris green or London purple about the time that the leaf-buds appear in April and ten days later, and at intervals until the blossoms have formed. The spraying, it will be observed, will have to be done earlier than for the codling-moth. This early operation will also destroy other species of leaf-rollers that make their attack simultaneously with the eye-spotted bud-moth.

Cecidomyia balsamicola Lintn. .

The Balsam Cecidomyia.

Dr. Roland Thaxter, Mycologist of the Connecticut Agricultural Experiment Station, has sent me tips of Fraser's or the southern balsam, *Abies Fraseri*, taken by him from the summit of Roan Mt., N. C., in 1887, containing galls which are apparently identical with those of the above-named species occurring on *Abies balsamea* in the Adirondack Mountains of New York, and in New Hampshire (see *Fourth Report on the Insects of New York*, 1888, p. 60). The perfect insect of this species is not yet known.

Inclosed in the closely-folded paper containing the infested tip of *A. Fraseri*, a small Chalcid was found. Suspecting it to be a parasite of the *Cecidomyia*, it was sent to Mr. L. O. Howard for name. Answer was returned that as the specimen had lost its head and front legs it could only be referred to the *Pteromalinae*. In this group, the characters are chiefly derived from the front legs and head, and it could therefore not be placed generically. It apparently belonged to a

section of the sub-family in which the species are mostly parasitic upon wood-boring beetles, and from this general fact it was thought that the *Abies* had been infested by *Tomicus* or some other Scolytid, and that this Chalcid was parasitic upon one of these rather than on the Cecidomyid.

Cecidomyia sp ?

Within a Jumping Gall.

The following note, accompanied with a rather rude drawing, was submitted to me by Professor Ballard, President of the Agassiz Association, who had received it from a correspondent in England. The note and my reply, are herewith given, as published in the *Popular Science News*, for August, 1890:

We have found a most curious insect on a bough of May blossom. Both in form and color it is exactly like a large bud of the blossom just before it opens. The skin is just turning a shade creamy, and is of very fine, leathery texture. It makes frequent bounds or springs from the table to the height of nearly six inches. Were it not for this, one would pass it by as a May-bud. Can you enlighten us ?

OATLANDS PARK, WEYBRIDGE, ENGLAND.

E. M. McD.

DEAR MR. BALLARD. — Thank you for permitting me to read the letter of E. M. McDowell, which has interested me much. You ask what the curious insect referred to therein, may be. It was something that I had never met with, nor read of, and I therefore sent the description given, to Dr. C. V. Riley, thinking that perhaps it might have come under his observation while in England, during his early life. He kindly returned me the following reply:

I was much interested in the account of the deformation of the May-bud, from my old boyhood tramping-ground, Oatlands, Weybridge. I regret to be unable to say positively what the deformation is. It must, however, be some kind of gall, and the movements are caused by the gall-maker; and as there is but one known to me, viz., the bedeguar of the hawthorn (*Cecidomyia crataegi* Winnertz), it is probably that species (see Kaltenbach), but I never heard of its jumping so.

I have not Kaltenbach at hand to refer to for a description of the gall, but in a publication on the "Gall-Making Diptera of Scotland," by Professor J. W. H. Trail,* I find on page 17: "*Cecidomyia crataegi*, Winn., often galls the terminal buds of the upper twigs of the hawthorn (*Crataegus oxyacantha*), producing a rosette of sessile deformed leaves, often covered with prickly hairs. The rosette may be an inch and a half across. Between the leaves lie several of the larvæ."

* A reprint from the *Scottish Naturalist*, 1888, pp. 281-88, 309-28, 373-82.

If we may accept the probable determination of Dr. Riley, the curious object observed must have been the gall of the fly, containing its nearly matured larva. Its remarkable bounds of nearly six inches in height (?) would be the result of the larva bending its body in an arched form and then by a strong muscular action suddenly throwing itself into a reverse position. It is quite probable that this gall is identical with that described in *Science Gossip* for December, 1867, in a communication from Ventnor, Isle of Wight, quoted by Mr. Charles R. Dodge in *Field and Forest*, ii, p. 55, as follows:

"The writer describes the 'jumping seed' as a 'small excrescence' which had been taken from a hawthorn; it was about the sixth of an inch in length, pear-shaped, and in size resembled a grape or raisin stone. The specimen had been seen to jerk or leap nearly an inch from a given point, though while in his possession it had not shown such activity, leaping only a third or a quarter of that distance. On opening the case, it was found to contain a whitish maggot, with a small, yellowish, scaly head, the body bent into a semicircle, and the tail-end slightly flattened. It had no legs, but the shining skin was deeply corrugated, or thrown into folds, which appeared to serve in some degree as limbs."

If the above description of the larva is approximately correct, it could not have been a *Cecidomyia*.

Quite a number of "jumping galls" and "jumping seeds" are known to science. Of the former, one of the most interesting is a species occurring as a small globular body of about the size of a mustard seed, formed on the under side of leaves of *Quercus obtusifolia*, *Q. macrocarpa*, and *Q. alba*, in California, Missouri, Illinois, Indiana, Michigan, and less frequently eastward. Sometimes a thousand of these galls are found on a single leaf. "The gall drops in large quantities to the ground, and the insect within can make it bound twenty times its own length, the ground under an infested tree being sometimes fairly alive with the mysterious moving bodies. The noise made by them often resembles the pattering of rain. The motion is imparted by the insect in the pupa, and not in the larva state." (Riley: *American Naturalist*, x, p. 218). The insect forming the above gall is known scientifically as *Neuroterus saltatorius* (H. Edwards).

Mr. Ashmead has published an account of another of these curious forms, which he has named *Andricus saltatus* (*Trans. Amer. Entomolog. Soc.*, xiv., 1887, p. 142). Two or three of the galls are formed on the bud-axils of the blue-jack oak (*Quercus cinerea*) in early spring, in Florida. "It appears the last of March, and when first taken from the tree and for several weeks thereafter, it has the power of jumping,

due to the contraction and sudden relaxation of the larva within: some of them will jump three-fourths of an inch from the table."

An interesting jumping gall was received by me last year, from a gentleman at Fort Edward, N. Y., which had been found beneath a tree leaping actively about, by his little daughter. Unfortunately, I was not able to obtain the insect from it and learn the particular species.

The most interesting of all these "jumpers" is, undoubtedly, the one popularly known as the "Mexican jumping seed," which is a large seed-vessel, of nearly half an inch in diameter, believed to be of a species of *Euphorbia*.[*] Its peculiar leaps, jumps, and tumbles are occasioned by the movements of the caterpillar of a small moth confined within, known as *Carpocapsa saltitans* Westwood. The insect borrows additional interest from the fact that it is congeneric with our well-known and common codling-moth (*Carpocapsa pomonella*), which is responsible for the annoyance of the fruit-eater, and serious losses to the fruit-grower, from the defilement, disfigurement, and destruction of the "apple-worm."

In my fourth report on the insects of New York, figures, and a pretty full account of these jumping seeds have been given, and reference made to other literature on the subject.

I regret that I can not give a more satisfactory reply to your inquiry — one which would enable you to return a positive answer to your correspondent.

***Epilachna borealis* (Fabr.).**

The Northern Lady-bird.

This lady-bird — one of the few *Coccinellidæ* which are chargeable with injury to vegetation, has been sent to me from Mr. Wm. Falconer, as having been remarkably destructive in the gardens and conservatories of Mr. Charles A. Dana, at Dosoris, L. I., during the summer and autumn. It had never before appeared in such numbers. Last year a few occurred, but during the present year it has multiplied enormously, and seemed to abound "by the millions." It has not been particular in its food, for every member of the *Cucurbitaceæ* is apparently acceptable to it and eagerly devoured. It has shown a special fondness for eating into the rind of melons — Mr. Falconer having taken from seventy to eighty from a single melon. Writing in October — at that time, "every nook and cranny about the sheds,

[*The plant has lately been determined as belonging to the genus *Sebastiana*, the species being undescribed. (See Riley, in *Insect Life*, vol. III, 1891, page 431.)]

wood-piles, and other convenient hiding-places, are full of them, searching for winter quarters."

The beetle is represented in Figure 29. It is of a luteous color; its eyes are black. The thorax is marked with four black spots, the largest of which is central near the hind margin. The wing-covers have seven black spots, two of which are common to the two covers.

It varies considerably in size — the largest measuring one-third of an inch in length.

The larva is described as yellow, with long, brown, branched spines, arranged in rows of six on each segment, except the first thoracic segment, which has only four. Its several stages, together with the egg, have been described by Professor G. H. French in the *Canadian Entomologist*, xv, 1883, pp. 189, 190.

In seasons of an ordinary abundance of this insect, it may be easily controlled by hand-picking, but in years of such an excessive multiplication as above recorded, it is almost a hopeless task to attempt to attain immunity from its depredations.



FIG. 29.—The northern ladybird, *EPILACHNA BOREALIS*. (After Emmons.)

Sitodrepa panicea (Linn.).

Referring to the notice of this insect as a leather pest, in Report iv pp. 88-92, Mr. A. S. Fuller, of Ridgewood, N. J., has called my attention to a communication made by him to "The Hub," of March (?), 1873, under the head of "A Pest of the Trimming Shop." A firm of carriage manufacturers, W. S. Bruce & Co., of Memphis, Tenn., reported serious injury to the curtains, falls, and cushions of their carriages, from the borings of a "worm," which, upon being submitted to Mr. Fuller, accompanied by the beetle into which it developed, was identified by him as the well-known pest, *Sitodrepa panicea*. The following are extracts from the letters of Bruce & Co.:

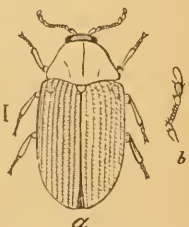


FIG. 30.—*SITODREPA PANICEA*.

We have been troubled during the last few years in our carriage rooms by a bug or worm, which not only destroys cloth linings, but also eats the leather in tops, cushions, and falls, more particularly when there is paste, as in the facings of the cushions and the falls. They bore little round holes through the leather on the outside, and in a little while it looks like a sieve, or the nozzle of a sprinkling can. They are worse in warm weather. On tearing apart cushion facings and falls, we have found in nests two kinds of white worms, one short and thick about three-sixteenths of an inch long, and the

other long and thin, from one inch to an inch and a quarter, which wiggles and runs like a snake. It is about the size of a large pin, and almost as sharp at the ends.

We have tried all remedies for this pest, such as are commonly used to destroy moths and other insects, but without any effect. They are very annoying and disastrous.

In a fall that we cut open, we found the worms in nests in the paste, between the leather and lining. We have about come to the conclusion that they are bred in the paste, * * * * for we never find them in any vehicles of our own make, the paste used in which we cook, which is not done in some Northern and Eastern States. The infested carriages were built up country.

The "two kinds of white worms" were not sent for identification to Mr. Fuller. The smaller one was undoubtedly the larva of *Sitodrepa panicea*; the larger was probably the larva of *Scenopinus fenestralis*, preying upon the larvæ of the clothes moths or some other insect infesting the cushions.

Aphodius fimetarius (Linn.).

A DUNG-BEETLE.

This little "dung-beetle" was sent to me, on May 6th, from the N. Y. State Agricultural Station at Geneva, infested with a large number of *Uropoda Americana* Riley—the mite that has several times been reported as attacking and killing the Colorado potato-beetle.*

Mr. G. W. Churchill, to whom I am indebted for the interesting specimen, informs me that it was found in a hot-bed of the Station, from which, last year, an example of the potato-beetle, similarly infested, was taken. It would seem from this, he thought, that they had a little parasite-farm at their command which might be utilized for infesting potato-beetles and other insect pests, and then turning them loose for the distribution and multiplication of the valuable parasite.

Professor Fernald, in a communication made to me, has expressed his surprise that mention was made in my "Third Report"† of Dr. Packard having observed this species in abundance on the carriage road of Mt. Washington, since "it is not only abundant on the White Mountains, but is common here [Amherst, Mass.] and also throughout Maine, where I have known of its abundance from my early childhood, and with it a species quite as abundant, viz., *Aphodius prodromus* Brahm."‡

* *Fifth Report on the Insects of New York*, 1889, pp. 289-291.

† *Report to the Regents of the University S. N. Y.* for 1886, p. 103.

‡ Although this species had long ago been introduced in this country from Europe, it had not, according to Professor Fernald, been recognized by coleopterists until a few years ago.

Although *A. fimetarius* is recognized as a quite common beetle in the Atlantic region, and in some other portions of the United States, it has rarely come under my observation in this portion of New York State. I have found it abundantly in the Adirondack mountains during the month of July — at Lake Pleasant, at Keene Valley, and elsewhere. Does it favor elevated localities?

Saperda candida Fabr.

The Round-headed Apple-tree Borer.

In an excellent article on "Insect and Fungus Enemies," contributed to the *Country Gentleman*, of March 20, 1890, by Mr. Woodbridge Strong, of Middlesex county, N. J., he has given in detail "a simple, ready, and complete protection" from this destructive borer,

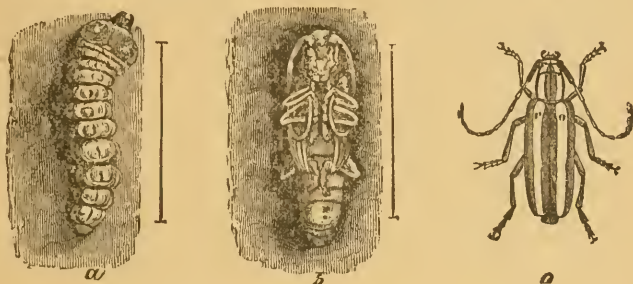


FIG. 31.—The round-headed apple-tree borer, *SAPERDA CANDIDA*; a, the grub or larva; b, the pupa; c, the imago or beetle.

which, although not entirely a new method, has never before been presented in so attractive a form, from its simplicity and assured effectiveness. The writer is evidently convinced that it is the best of all known methods of protection, and we are not disposed to question his conclusions, so far, at least, as employed for nurseries and young orchards. He has written as follows:

It is well known that the borer never gets into the stem, otherwise than as the result of an egg laid by the winged insect in a puncture made by her in the bark, at or just above the ground surface, usually in May or June. If that point is effectually covered against her at that time every season, of course the egg never gets there, nor the consequent boring worm. For this covering nothing is equal to a newspaper or some other soft paper.

Fold a newspaper into three or four thicknesses, remove the earth at the foot of the tree two or three inches deep, and wrap the paper from the bottom of the hole about the stem for at least a foot above the ground, crushing the paper tightly in so as to fit all depressions in the stock where the insect might creep under and down; tie all tightly with a string frail enough to break when the stem shall expand

in midsummer or later, and bring the earth back and tramp it at the foot of the tree. This simple plan I have followed for some six seasons, and no borer has ever entered a tree thus guarded.

The wrap should be put on early in May, and need never be touched thereafter, until the same time the ensuing spring, when the protection is renewed. On its removal, the healthy expansion and appearance of the trunk thus covered show the value of the bandage, also, as a shield against summer's sun and drying winds, * * * and as a protection in winter against the alternations between the low temperature of the night and the bright sunshine that often follows the next day. * * *

Every season I read in horticultural papers directions to wash the stems of trees with mixtures of soap, soda, and other substances, and to rub the trunks with offal or with bloody and greasy things to render the point of attack of borers, mice and rabbits too vile for even their mean work. Throw these all aside, and rely entirely on the paper wraps of any number of thicknesses you may choose, above two, and you will wonder why any other protection was ever thought of. But there must be no omission, and the work must be carefully done early in every May, against borers, or in November against mice and rabbits.

Mr. Strong also narrates in the same article with the above, the success that he has attained in immunity from the same borer in his quince trees, by setting out only such trees as have been worked upon stocks not attractive to it. After experimenting with the various varieties of the English hawthorn or *Crataegus oxyacantha* and finding that they were also subject to the attack of the borer, but that its ravages therein were less extensive, and better sustained, and more quickly repaired, he finally obtained better results with our native thorns, and particularly with *Crataegus crus-galli* and *C. coccinea*. From the many varieties of these two species — to use his own words — “after many years of trial, I have selected two so practically borer-proof, that while they have been left wholly exposed to their attacks, I have never known one among many hundreds to be at all injured.”

Professor J. B. Smith's recent observations of this insect, have clearly shown, what had before been reported, that its oviposition and borings, are not confined to the base of the tree, but that they also occur at various heights upon the trunk and extending upward even into the base of the main branches. It will therefore be seen that the application of washes or wraps to the base of the trunk, generally recommended, does not give complete protection from the injuries of this pernicious borer.

For an account of the oviposition of the beetle, reference may be made to my Fifth Report, 1889, pp. 127-129 (269-271 of the State Museum Report).

Diabrotica 12-punctata (Oliv.).*The twelve-spotted Diabrotica.*

The above-named well-known Chrysomelid, represented in Figure 32, has been received from Mr. Wm. Falconer as having been (in association with the *Epilachna* noticed in a preceding page) a great annoyance and very injurious during the summer and in October, as despoiling the Chrysanthemums and Dahlias, in eating and riddling the petals. According to Mr. Falconer, it appears to feed on almost everything, and is present in so great abundance, that it seems useless to attempt any remedy. Sprinkling with pyrethrum water was suggested, but Mr. Falconer had but little confidence in an application of this character, for a beetle so alert and active and which so readily takes wing when disturbed.



FIG. 32.—The twelve-spotted *Diabrotica*, *DIABROTICA 12-PUNCTATA* enlarged, with further enlargements of parts (After Emmons).

In addition to its large number of known food-plants, it has recently been reported as feeding to an injurious extent upon the foliage of the peach, and also on cabbage in southern Mississippi (S. F. Earles, in *Entomological News*, i, 1890, p. 152).

THE FUNGUS OF

Phytonomus punctatus (Fabr.).*The Clover-leaf Weevil.*

The fungus that attacked and quickly killed the young larvæ of *Phytonomus punctatus* at the farm of the N. Y. Agricultural Experiment Station, at Geneva, in the spring of 1885, was noticed in the *Fifth Report on the Insects of New York*, 1889, p. 272, as *Entomophthora Phytonomi* Arthur. At that time, the careful study made by Dr. Roland Thaxter on "The *Entomophthoræ* of the United States," as published in the *Memoirs of the Boston Society of Natural History*, vol. iv, No. vi, April, 1888, had not come under my observation. In this publication, Dr. Thaxter has referred the *E. Phytonomi* of Prof. Arthur, after examination of material from Geneva, N. Y., which had passed through my hands, to the *Entomophthora sphaerosperma* of Fresenius, published in 1856.



FIG. 33.—Fungus-attacked larva of *PHYTONOMUS PUNCTATUS* coiled about the tip of a blade of grass. Enlarged five diameters.

This species of fungus, according to Dr. Thaxter, is peculiar from its infesting so many widely differing insects, distributed through all the orders except the Orthoptera. It has been found on a *Pieris* caterpillar; a *Colias Philodice* butterfly; several species of *Ichneumonidæ* and a small bee; the common house-fly and several species of *Culicidæ*, *Mycetophilidæ*, *Tipulidæ*, and other families of Diptera; one of the Lampyrid beetles; an aphid and on some of the leaf-hoppers (*Typhlocybe*); a *Limnophilus* among the Neuroptera; and upon Thrips sp. in the larva, pupa, and imago. In two instances it had been seen to prevail as an epidemic.

Professor J. B. Smith reports, that in the spring of 1890 and again in 1891, the clover-leaf beetle in New Jersey (locality not stated), when appearing in great number and threatening destruction, was attacked and were nearly all killed when about half-grown by a fungoid disease (*Insect Life*, iv, 1891, p. 43). In the absence of direct statement, it is to be presumed that the fungus was the *Entomophthora sphaerosperma*.

Monarthrum mali (Fitch).

The Apple-tree Bark Beetle.

Mr. C. M. Hedges, of Charlottesville, Va., has reported the death of an apple tree, which he found "filled from the top to the bottom with a small white larva."

The bark from the piece received easily separated from the wood in comparatively thin sheets (in the more infested portions) which alone remained of it. Its inner portion had been consumed by the larvæ which had also made part of their burrows in the wood underneath, after the manner of these bark-borers—half in the bark and half in the wood. The burrows curve and run in every direction but with rather a longitudinal tendency. In a few places are seen a different kind of burrow, running straight the length of the trunk for about an inch, with elevated margins of portions of uneaten bark: leading into these margins may be seen a row of minute punctures as if made by the point of a pin, as close almost as they could be made. These burrows are those of the parent beetles, and at each of the lateral holes a young larva had entered the bark after hatching from the egg—a row of eggs having been placed in little niches excavated for their reception on each side of the burrow. At the end of one of the straight burrows, a dead beetle (one of the parent beetles doubtless) was found on peeling off the bark above it, permitting the identification of the architect as *Monarthrum mali*.

As the young larva approach their pupation they sink their burrow within the wood until it is contained wholly therein, to a depth not exceeding one-eighth of an inch. A transverse section before me, of six-tenths of an inch diameter, shows nine of these burrows, in one of which, quite near the surface, the head of a pupa is seen.

This beetle is the *Tomicus mali*, of Dr. Fitch's Third Report, wherein the beetle is named and described, but with no mention of its burrows.

The above notes were made several years ago. On referring to the description by Mr. Schwarz, of the galleries and sub-galleries of *M. mali*, contained in the *Proceedings of the Entomological Society of Washington*, i, 1890, pp. 44, 48, it is found to disagree entirely with that of the burrows as above described. It would seem, therefore, that the example identified, as above, was not the infesting beetle of the apple-tree, but was only incidentally present in association with the more abundant species. What was this species?

Aphis brassicæ Linn.

The Cabbage Aphis.

Mr. E. P. Van Duzee, of Buffalo, N. Y., reports this insect as exceedingly abundant in many of the gardens of the city during the autumn of the present year. Its parasites and predaceous enemies seemed correspondingly abundant, and it was expected that their multiplication would tend to prevent the appearance of the pest in unusual numbers in the following year (*in lit.*).

A similar abundance of the species was noticed in New Jersey, by Professor John B. Smith, who states in Bulletin No. 72, of the New Jersey Agricultural College Experiment Station: "This insect has been unusually abundant during the year. The plants were sometimes so crowded with the lice that it was impossible to see the leaves, and the plants were so devitalized that they failed to grow."

In the above-named Bulletin, Professor Smith has illustrated the antennal structure of the species, showing the peculiar sensory pits which, in this family, afford good specific characters. The same is

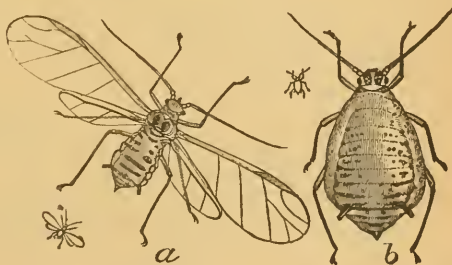


FIG. 34.—Winged and wingless females of the cabbage aphid, *APHIS BRASSICÆ*, enlarged.

given, in comparison with other species, in *Psyche*, v, 1890, p. 411. The beak structures are also shown.

The Entomologist of the Dakota Agricultural Experiment Station has reported of the excessive multiplication of the species in the preceding year (1889), in that state, as follows: "It often crowds the upper and under sides of the foliage in such numbers that the leaves become hidden by the living mass. Indeed, sometimes, weight for weight, there is more animal than vegetable substance present."

In *Insect Life*, iii, 1891, p. 289-90, Professor C. M. Weed, has described and illustrated the sexed forms of *A. brassicæ*. They had never before been given, although the insect has been known in both Europe and America for more than a century. Careful descriptions of the winged male, the oviparous female, and of the egg are contained in the notice.

Remedies.—This insect can be effectually controlled by spraying with a kerosene emulsion, or with one pound of whale oil soap dissolved in eight gallons of water. In order to reach the aphids when congregated on the under side of the leaves, it is desirable to use one of the knapsack sprayers furnished with a Vermoral nozzle.

Other remedies are named in the notice of this insect contained in the *Sixth Report on the Insects of New York* p. [52] 148.

? *Myrmeleon immaculatus* (De Geer).

A STRANGE HABITAT FOR THE LARVA.

An ant-lion, apparently about half-grown, was received June 3d, from Mrs. E. B. Smith, of Coeymans, N. Y., who had found it beneath a



FIG. 35.—The spotless ant-lion MYRMELEON IMMACULATUS. (After Emerton.)

carpet in her house. It differed so much in its colors and in structural features from the only species with which I am familiar, *M. immaculatus*, (often observed and collected by me beneath the overhanging limestone rocks of the Hel-

derbergs, and reared in a few instances) that I had no thought of its being, by any possibility, that species. Added to this, when placed upon the table it traveled both forward and backward with almost equal facility, and when laid on sand, it manifested no disposition to run a circular furrow or to construct a pitfall. Its habitat seemed also most remarkable for

an ant-lion. Finding no mention of similar habits pertaining to any of our species, the insect was sent to Dr. Hagen, of Cambridge, Mass., who has made special study of the *Myrmeleonidæ*, for its determination. To my great surprise it came back to me as "probably *M. immaculatus*."

From that time to the present it has been kept in a jar with sand, in which it has partially buried, but has never made a pitfall. At first, most of its body was concealed beneath the sand, leaving its head exposed and jaws extended with which to seize any small insect placed within its reach. It was occasionally given young caterpillars, but most of its food has been the smaller flies taken from the windows. Later, it was content to have but a portion of its body in the sand—a few of the terminal segments. For perhaps a month past it has declined taking food, and has only occasionally changed its location. At the present time, November 15th, it shows but little vitality. As it may possibly be preparing for hibernation, in which state the larva has been known to pass the winter when in confinement, the box of sand containing it has been removed to a cold room where it may find winter quarters, if that is its purpose.

NOTE.—It survived the winter, and was still living when examined on May 7, 1891, but declined taking food, and died a few days thereafter. Could it possibly have been a species of *Ascalaphus*, of which the larvæ do not make pitfalls or move backward? (see "Notes on the life-history of various species of the Neuropterous genus *Ascalaphus*," by J. O. Westwood, in *Transactions Entomological Society of London*, for 1888, part 1, pp. 1–12). It showed marked structural differences in the head, mandibles, etc., from specimens in the state collection, received from Annapolis, Md., taken from their sand pitfalls, and identified by me as those of *Myrmeleon immaculatus*.

Dendroleon obsoletum (Say).

A Climbing Ant-Lion.

The first winged example of this species that had occurred to me in New York was brought to me in September, 1883, by the lady, Mrs. E. B. Smith, of Coeymans, who has been so fortunate as to capture the larva of the preceding species. Dr. Hagen, to whom the specimen was submitted, states of it: "It is the same as *ocellatus* Burm. and *nigrocinctus* Ramb., Walker; very



FIG. 36.—*DENDROLEON OBSOLETUM*.

much like *M. pantherinus* Fabr. (*ocellatus* Borsch) from Europe. The larva lives on trees—described and raised by F. Brauer.

Another example of *D. obsoletum* was taken by a lady at Palenville, N. Y., Catskill mountains, on August 6th, 1884, and I have also received it, in two examples, from Mr. G. F. Pierce, taken by him at South Britain, Conn. It is figured by Dr. Packard, in his *Guide to the Study of Insects*, 1869, p. 612, fig. 604, who remarks of it: "Not rare in the warmer parts of the country, and has been found at Salem, Mass., by Dr. E. P. Colby.

Dr. Hagen has described the winged insect in his *Synopsis of the Neuroptera of North America*, 1861, p. 225-26, where he gives as its habitat. "United States, not rare (Say); New York; St. Louis, Mo.; Alabama; Maryland."

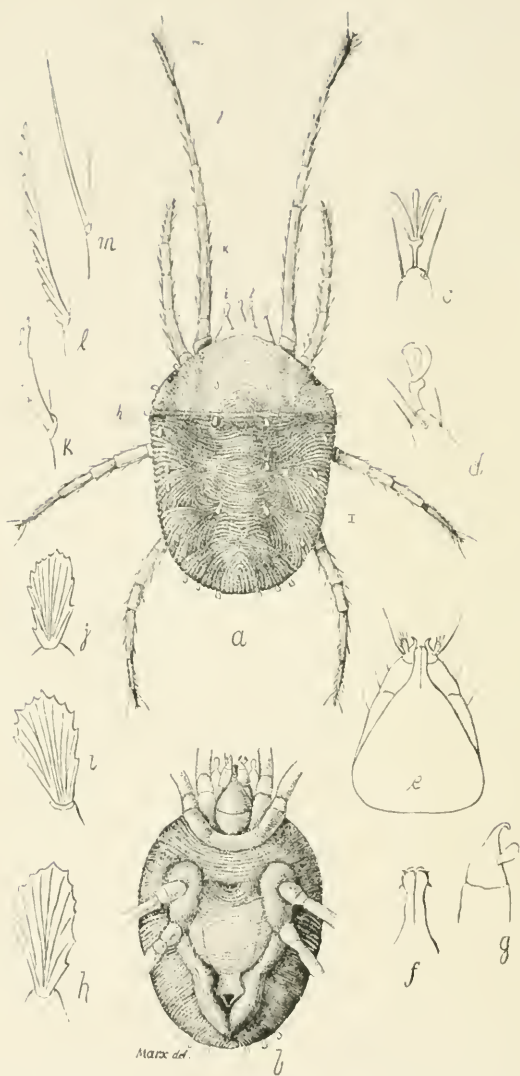


FIG. 38.— The clover mite, *BRYOBIA PRATENSIS*: *a*, female, from above; *b*, do, ventral view, with legs removed; *c* and *d*, tarsal claws; *e*, proboscis and palpi from below; *f*, proboscis enlarged; *g*, palpus enlarged; *h*, one of the body scales; *i*, scale from outer cephalic-thoracic projection; *j*, scale from inner cephalic-thoracic prominence; *k*, serrate hair from basal joint of leg; *l*, same from penultimate joint; *m*, spine of last joint; *a*, *b*, greatly enlarged; *c*-*m*, still more enlarged.

INJURIOUS ARTHROPODS.

Bryobia pratensis Garman.

The Clover Mite.

(Class ARACHNIDA : Ord. ACARINA : Fam. TROMBIDIDÆ.)

- LINTNER : in Count. Gent., xlv, 1881, p. 376 (infesting clothing).
Trombidium ?bicolor Herm. LINTNER : in Count. Gent., xlvii, 1882, p. 395 :
the same, [3d] Rept. St. Ent. to Regents, for 1886, pp. 128-130 (on
timothy).
Bryobia sp. RILEY : in Rept. Commis. Agricul. for 1884, 1885, p. 413 (infest-
ing houses in Diamond Hill, R. Isl., and Waltham, Mass.).
——— FORBES : 14th Rept. Ins. Ill., 1885, p. 73 (on clover and grass).
Bryobia pratensis GARMAN : in 14th Rept. Ins. Ill., 1885, p. 73, pl. 6, f. 7
(description); in *Prairie Farmer*, for June 26, 1886.
Bryobia pallida GARMAN : in 14th Rept. Ins. Ill., 1885, p. 74 (description of
immature form).
——— COOK : in Mich. Farmer, for Jan. 9, 1888 (in houses in Scotts,
Mich.).
Bryobia sp. LINTNER : in Ohio Farmer, for April 13, 1889, p. 274; as *B.*
? pratensis, 6th Rept. Ins. N. Y., 1890, pp. 62-65 (occurrences of,
habits, and remedies); in Albany Evening Journal, for Sept. 5, 1890,
p. 5 (in a water-trough, etc).
Bryobia sp. ? WEBSTER : in Insect Life, i, 1889, pp. 277-279 (infesting houses
and timothy in Ind.).
——— WISNER : in Insect Life, i, 1889, p. 252 (by roadside and in
fields, in Mich.).
Near *Tetranychus*. RILEY-HOWARD : in Insect Life, i, 1889, p. 252 (refers to
prec.).
Bryobia pratensis. RILEY-HOWARD : in Insect Life, ii, 1890, p. 279 (in houses
in Wilmington, O.).
——— ELLIS : ib., p. 278 (injury of the prec.).
Bryobia pratensis Garman. RILEY-MARLETT : in Insect Life, iii, 1890, pp.
45-52, figs. 4, 5 (history, distribution, life-history, remedies, descrip-
tion of stages).

This minute, spider-like red mite has, during the past ten years, as may be seen from its bibliography above given (all of which is believed to refer to it), been frequently brought to our notice from the immense number in which it has occurred in clover, timothy and other grass fields, and the serious annoyance which it has caused in its entrance in myriads in dwelling-houses. It was first given scientific

name and description by Professor Garman, in the year 1886. Recently, it has been studied at the Entomological Division of the U. S. Department of Agriculture, and a valuable paper upon it has just been published by Dr. Riley and Assistant Marlett of the Division, to which the reader is referred for its life-history and all other needed information of it. The paper is illustrated by carefully executed figures, which, by permission of the Division, we are permitted to present herewith.



FIG. 37.—The larval clover mite, *BRYOBIA PRATENSIS*.

occurring upon the apple, plum, cottonwood, and almond trees, from several localities in California. It has also been observed in Oregon, Montana, and Utah, and to the eastward, in Iowa, Indiana, Illinois, Ohio, New York, Massachusetts, Rhode Island, and District of Columbia.

Distribution.

It appears from the above paper that the mite has been identified in its eggs

Food-plants.

The paper further represents it as being a very general feeder. "Many of the trees on which it has been found, however, evidently serve but to furnish winter-quarters, and are not especially attacked by the young and adults during the summer months."

"Of the forage plants, clover and timothy are especially attacked; the former being perhaps the ordinary food-plant of the mite. Of trees, the apple and arbor-vitæ are frequently infested with all stages during summer, and the occurrence of eggs and adults in autumn and winter on almond, plum, prune, poplar, elm, and other trees, would indicate that these are also attacked."

Occurrence at Schodack Center, N. Y.

In my Sixth Report, several appearances of the mite in New York and other States, are recorded. The following was brought to my notice during the month of August of the present year, in this inquiry, from a correspondent at Schodack Center:

Will you please answer the following in relation to the mite that has appeared the past week in a barn-yard here, and oblige many who are interested in it. The insect is so small that it would hardly be discernible to the naked eye, were it not for its color, which is a beau-

tiful carmine red. They infest the water-trough mostly. The water is brought to the yard from a spring about forty rods distant through a lead pipe, and has been there for fifty years. There are myriads of the mites, and they move very slowly. What they will do or where they will go is what we would like to know.

Answer was returned, as follows: The little creatures of which inquiry is made, are not true insects. They belong to the *Acarina*, not far removed from the spiders, in the order of *Arachnida*. They are true mites and doubtless pertain to the genus of *Bryobia*. Within a few years past we have had many accounts of these red mites (probably all are of the same species) occurring on grass, clover, and other vegetation, and entering dwellings at certain times and swarming over bedding, carpets, clothing, furniture, etc., to the great annoyance and disgust of the occupants.

The source of the mites in this instance may be either the ground and plants near the water-trough, or the spring. Examination would probably show whence they came. They would not harm the cattle or other animals that might be watered at the trough; and in all probability they will soon disappear, perhaps not to be seen again in years. We are glad to receive accounts of all such occurrences of these mites, and would like to have examples sent us that we might see if they belong to the species which has recently been named and described as *Bryobia pratensis*. Their study has been too long neglected in this country, for they are of considerable economic importance. Further information of their appearance at Schodack Center would be acceptable—of their continuance, their habits, their extent—if observed elsewhere than in the water-trough, some idea of their number, etc.

The following extract of a letter received from Dr. R. Morey, of Old Chatham, N. Y., narrates a similar occurrence of what was probably the same mite as the above:

I found this season [1889] in July some specimens in a watering-trough nearly covering its surface, of which I secured a number to send to you, but owing to illness I failed to do so. When afterward going for more they had disappeared—a heavy rain having intervened. They were small mite-like creatures, which could be better examined with a power of about fifty than with the unaided eye, but I was too ill to make the examination.

The place where these were seen must have been near to that of the Schodack Center occurrence—within the ride of Dr. Morey. It would be of interest could it be ascertained that both were at the same watering-trough, in consecutive years.

Occurrence at Ausable Forks, N. Y.

Mrs. H. D. Graves, of Ausable Forks, has written me of her observation of this same mite upon the walls of a church edifice near her residence.

The mites were seen five or six years ago, in March? ("during Lenten services"), as red spots upon a cement covered wall of the porch of a stone church at Ausable Forks. Some of the clusters in which they had gathered, as estimated, would have twice filled a tablespoon. They were of so bright a red color that they suggested blood to the observers. In appearance, when examined with a magnifier, they closely resembled the "red spider" of the green-house, except that they were two or three times as large. The cracks in the cement seemed full of them, so that they were smoked out with sulphur and then killed by applying kerosene. No plausible conjecture could be made as to their source. The church yard is in grass, with a small elm growing near the porch. The weather at the time of their observation was of a freezing temperature. They have not since reappeared.

Cermatia forceps (Raf.).

A Household Centipede.

(Class MYRIAPODA: Ord. CHILOPODA: Fam. SCUTIGERIDÆ.)

- WALSH: in Amer. Entomol., i, 1869, p. 252 (in Missouri, and harmless).
 RILEY: in Amer. Entomol., ii, 1870, p. 182 (common in houses west).
 CURTIS: in Amer. Naturalist, viii, 1874, p. 368 (poisonous bite).
 LINTNER: Fourth Rept. Ins. N. Y., 1888, pp. 123-134, fig. 53 (general notice);
 Fifth Rept. do., 1889, pp. 295-6 (food).
 DALL: in Insect Life, ii, 1890, p. 315 (at Washington, D. C., and inquiry of).
 RILEY-HOWARD: in Insect Life, ii, 1890, p. 316 (habits).
 FLETCHER: in Entomolog. News, i, 1890, p. 167; in Insect Life, iii, 1890,
 p. 85 (capture of Croton bugs).
 HARGITT: in Insect Life, iii, 1890, p. 85 (numerous in Ohio, and habits).
 For additional Bibliography, see Fourth Report Ins. N. Y., 1888.

Additional Notes.

Since my former notices of this Centipede, which has special interest to us, in consideration of its disposition to domesticate itself within our dwellings, some additional information in regard to its distribution, its habits, and the poisonous nature of its bite, has been obtained, which is deemed of sufficient interest to warrant its being given at the present.

In a letter recently received from Mr. S. S. Rathvon, of Lancaster, Pa., who apparently has an almost exhaustive store of untold observations upon insect lives and habits, he has given me the following account of his early acquaintance with the *Cermatia*, which is particularly valuable as antedating all the published records of the domestic habits of this strange creature.

Observed in Pennsylvania in 1849.

From the spring of 1841 until the close of 1848, my residence was in Marietta, Pa. During that period, I actively canvassed the townships of East and West Donegal, in Lancaster county, and Hallom and adjoining townships in the county of York—in fact it was the most active period in my life in field entomology. During all of the above time I never saw a single specimen of *Cermatia forceps*; but the first year after my removal to Lancaster I met them frequently, especially in the cellars of old buildings. My place of business was at No. 101 North Queen street, and my private residence at No. 506 on the same street, in an elevated location. At the former location they were large and of a bluish-green color. About the second or third year they began to appear in the cellar and also in the upper rooms of my residence, but not so large nor yet so highly colored—more of a drab color, except the feet, which were white.

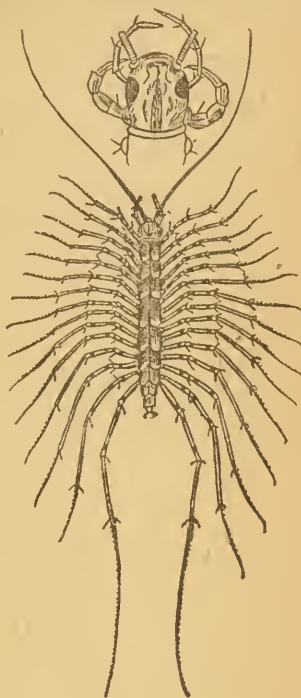


FIG. 39.—*CERMATIA FORCEPS*.
(After Wood.)

A Cockroach-killer.

In the same building, with only a four-inch wall between us, lived a Mr. James G. Thackara, an agent of the Adams Express Company. His house was more infested than mine, and he frequently brought me fine specimens of them. He called them the "Cockroach-killers," and he related some of his observations in reference to them, as follows:

On two or three occasions he witnessed conflicts between them and the cockroach [*Periplaneta orientalis* (Linn.)], which always ended in the death of the roach. The roach seemed to be conscious that he had engaged in conflict with his deadly enemy; he made no attempt to escape, but raised himself up as high as he could on his feet, and seemed to have his eye fixed upon his foe—both animals apparently reconnoitering and trying to get the vantage ground. This might continue for from ten to fifteen minutes, until the myriapod would seize the first opportunity to pounce upon the roach at an unprotected point and get him in his embrace, when after a very short time he would relinquish his prey and leave him dead upon the field. What

he would have done with the roach had he not been disturbed he could not say, for in attempting to secure the one the other ran away.

I have often noticed them on my desk while I was writing late at night, when they would remain fixed as a statue for twenty minutes or more, but would disappear as quick as lightning if I made the least movement toward them. They themselves may in turn be fed upon by spiders, as I have often found their dead bodies in spiders' webs in cellars and outhouses. I have, however, never witnessed such a contest as Mr. Thackara described.

Its Capture of the Croton-bug.

That the *Cermatia* found a portion of its food in the Croton-bug, *Ectobia Germanica* (Fabr.), has been suspected from its known food-habits. At the last meeting of the Entomological Club of the A. A. S., at Indianapolis, Ind., Mr. James Fletcher reported his having observed its capture of this insect at Washington, D. C., and described its method as springing upon its prey and encaging it between its many curved legs (*Entomological News*, i, 1890, p. 167).

Its Distribution Northward.

In my first notice of this myriapod, it was represented as a southern species gradually working its way northward (*4th Report Insects New York*, page 130), it having first been seen in New York city in the year 1867, and in Albany in 1870. The above reminiscence by Dr. Rathvon, locates it in Lancaster county, Pa. (Southeastern portion of the state), many years previous to these dates, indicating quite a slow progress for a creature of such remarkable cursorial powers.

Is it a Desirable Guest?

In the same notice, it was intimated that *Cermatia* presence in dwelling-houses was for the purpose of feeding upon some of the smaller insects that commonly frequent them. In the succeeding report (*Fifth*, p. 296), it was shown as rendering some return for its disagreeable presence, by catching and greedily feeding upon flies. Now that it is presented in the role of a cockroach and Croton-bug killer, its companionship might even be invited in our houses, were it not that in further study of its habits, we have evidence that leads us to accept it as not only capable of inflicting a poisonous bite, but ready to do so under provocation.

Its Occurrence in Missouri.

A late communication from Mr. Gilbert Van Ingen, of Clinton, Mo., gives the following notes of its occurrence in localities in Missouri where it has not been previously recorded:

At Higginsville, Lafayette county, Mo., I saw an individual running across the floor of the hall of the second story. At Osceola, Mo., I

found another between the sheets in my bed at the hotel. I have often found them under stones and logs in St. Clair county, Mo., and occasionally in the same habitats about Clinton, Mo.

Its Poisonous Bite.

Mr. Van Ingen also gives an account of a bite received by him, which without doubt was inflicted by the *Cermatia*:

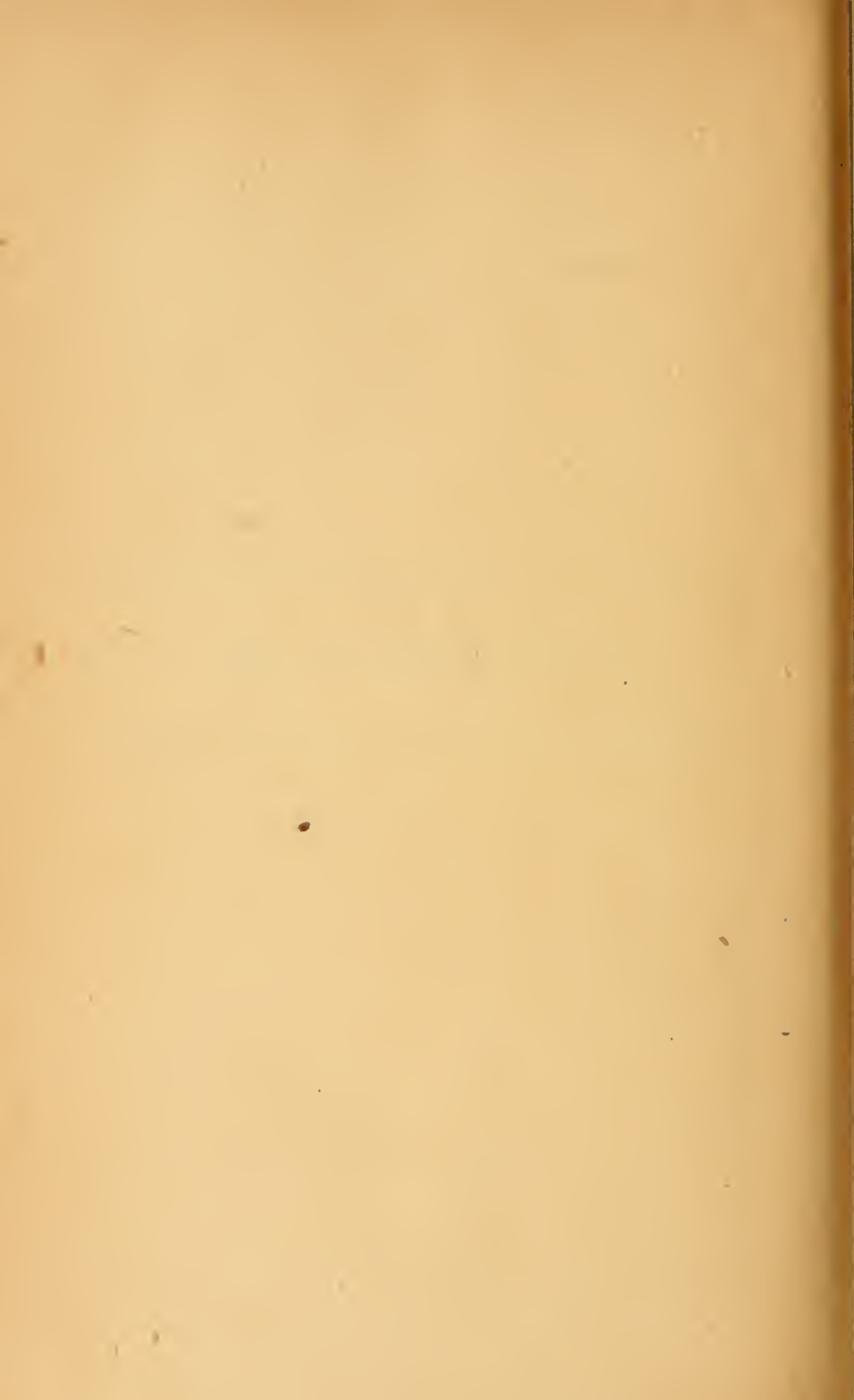
It is poisonous, sometimes fatally so. The one at the hotel at Osceola bit me in two places on the body. The flesh around the bites became much inflamed and swollen, but did not fester. This condition continued for four or five days, after which the swelling and inflammation gradually subsided. Dr. J. H. Britts has told me that he knows of a case in which a child was bitten by a *Cermatia* and died from the effects. You state that there is no record of its bite having been inflicted upon a human being. I did not see the *Cermatia* bite, as from the circumstances it was impossible to do so, but I felt the pain, and getting up and lighting a lamp and making examination for the cause, I found the *Cermatia* between the sheets. In each of the wounds, the punctures made by the two mandibles were distinctly visible as small inflamed spots.

The poisonous nature of its bite had been recorded several years ago in a note to the *American Naturalist*, for June, 1874, which had been, until recently, overlooked by me. In it, Dr. Josiah Curtis, of Washington D. C., wrote that a lady in the house with him had been bitten upon her foot, by stepping barefoot upon a *Cermatia* in the dark. She at first thought she had trodden on a carpet tack, but the sensation was quite different soon, being more like the effects of a coal of fire. On lighting the gas the creature wounded by her tread was found. The bite was followed by much swelling in the foot, but taking medical advice, it yielded to an application of ammonia and camphor. The swelling and pain continued for thirty-six hours, meantime keeping the lady awake for nearly an entire night.

In view of the above statements, where the fact of poisonous bites having been inflicted under provocation will not be questioned, the instance given in my 4th Report (page 134) of a supposed *Cermatia* bite, in the dormitory of a boarding-school [in Albany, N. Y.], will also be accepted as adding a third to the number of such occurrences.



APPENDIX.



(A)

ENTOMOLOGICAL CONTRIBUTIONS.

The two following papers are published in this place, for convenience of reference, and as partly supplementing the brief report of the preceding year:

THE INSECTS OF THE PAST YEAR, AND PROGRESS IN INSECT STUDIES.

[Read before the N. Y. State Agricultural Society, at its Annual Meeting, Jan. 23, 1889.]

GENTLEMEN.—Instead of asking your attention at this time to the consideration of some particular insect pest, as I have done on former occasions, it will, I am sure, be of more interest if I offer a brief review of the more important insect attacks of the past year within the State of New York, coupled with the absence of those that might have been expected to occur, and a few remarks on progress made in insect studies.

[Following were notices of the operations of the grain aphid, *Siphonophora avenæ* (Fabr.); an attack in July, of the hop aphid, *Phorodon humuli*. (Schrank); abundance of the apple-tree tent-caterpillar, *Clisiocampa Americana* Harris, in connection with the neglected apple orchards of the State; a remarkable multiplication at Kingsbury of the forest tent-caterpillar, *Clisiocampa sylvatica*; absence of the usual injuries of the caterpillar of the white-marked tussock-moth, *Orgyia leucostigma* (Sm.-Abb.); and two weevils, *Otiorhynchus ovatus* (Linn.) and *Silvanus Surinamensis* (Linn.) infesting dwelling-houses. These are omitted, having been included in the introduction to the preceding (6th) Report of the Entomologist.]

THE CHINCH-BUG IN WESTERN NEW YORK.

In my Second Report, several pages were devoted to observations on the Chinch-bug, *Blissus leucopterus* (Say), in Jefferson county, in the year 1883, where so large an acreage of grass and clover was destroyed by it, as to occasion great alarm, and excite the fear that it was destined to become one of the permanent pests of our State, as it for a long time has been of several of the western states.

Professor Forbes, State Entomologist of Illinois, has written of it: "It is the most dangerous insect foe with which we have to deal. That it taxes them more heavily than all other such enemies combined, is burnt into the convictions of thousands of farmers by repeated heavy losses and bitter disappointment."

The following year, 1884; as the result of the thorough plowing, burning, and other active measures with which it was met, and no doubt, also to seasonal conditions unfavorable to it, it did not reappear in northern New York, in injurious number. Since that time, I have had no knowledge of further injuries from it, until quite recently, a correspondent, Mr. Van Duzee, of Buffalo, who is making special study of the order of Hemiptera, to which the chinch-bug belongs, has written me of serious losses resulting from its presence, in Erie county, particularly in the central portion of the county, near Lancaster. He reports a field of three-acres of timothy grass at Lancaster, which in 1888 yielded as fine a crop as was ever seen, the past year not worth the cutting, as the result of the operations of the bug. Fortunately the attack was arrested and kept from spreading as it gave every indication of doing, by the cold heavy rains that commenced on the 18th of May and continued for nearly a month, followed by the notable sharp frost on the 29th of May. Many of the farmers had complained to him of serious injuries to their hay crops in 1888 and 1889, "from the bug."

THE GRAPEVINE FLEA-BEETLE.

The grapevine flea-beetle, *Haltica chalybea* (Ill.) is apparently on the increase in western New York, and is becoming a pest of the grape-growers, if we may judge from the frequent inquiries received of its habits and how to deal with it. Its multiplication should not be permitted, but should be persistently fought by breaking up or removing in the autumn its usual places of hibernation, as loose bark and the refuse material of the vineyard, and by preventing the beetle eating out the heart of the buds in early spring. It is claimed that this form of injury can be prevented by spraying, in March, with a mixture of lime-wash made with brine, to which is added some London purple. The grapevine leaf-hoppers are also occasioning a great amount of harm. I purpose as soon as may be, to give them special study.

THE COW-HORN FLY.

A new insect pest has been exciting much interest in adjoining states—in New Jersey and Pennsylvania during the past year. As yet, it has not, to my knowledge appeared in the State of New York, but as it will in all probability soon extend its range hither as it is

rapidly spreading northward, a few words in relation to it may serve to give early knowledge of its presence, and thereby enable farmers to meet it promptly and check its increase.

The larger number of our most harmful insect pests have been brought to us, from Europe, and this is one of the latest additions to the extended list of much to be regretted importations that might be given. It is native to the south of France — was first noticed in Pennsylvania in 1886, and from its habit of collecting in masses on the horns of cattle so as completely to cover and blacken them toward their base, it has been given the common name of the "cow-horn fly." Other names that have been applied to it, are "cow-fly," "horn fly," "Texan-fly," and "Buffalo-fly." Scientifically it is *Hæmatobia serrata* R. Desv. It is a small insect, not so large as the common house-fly but resembling it in general appearance, and is quite closely allied to the common biting fly, *Stomoxys calcitrans*, which often greatly annoys cattle and horses by inflicting its sharp bite, usually upon their legs. Unlike that, however, this confines its attack to cattle, not extending it to horses, mules, or man. Greatly exaggerated statements were at first made of the injury wrought by the fly. Common report represented it as depositing eggs at the base of the horn, the larvæ hatching from which burrowed into the head, entering the brain, and often causing the death of the animal within twenty-four hours.

As soon as scientific study could be given the insect, it was found that the harm resulting from the presence of the fly was not so serious as to be the occasion of alarm. No deaths had resulted from it, and the cows were not dehorned by it. In the thinner-skinned and more sensitive animals, as the Jerseys, the bites, and bloodsucking and resulting inflammation might, perhaps, through rubbing, produce sore and bleeding spots. The amount of harm caused by the fly seems to be narrowing down to a falling off in the amount of milk and cream of infested herds, reported by some at one-third, and in one instance, in New Jersey, at one-half of the usual production.

The life-history of the fly has been studied out, and published, by the Division of Entomology at Washington,* and by Prof. J. B. Smith, of the State Agricultural College of New Jersey. Its eggs are deposited in the fresh droppings of the cattle. The larvæ, feeding and maturing therein, may be destroyed by a daily sprinkling of the droppings with lime, or better still, as not liberating the ammonia, with plaster. Protection from the bite may be had by the application of oils to the body of the animals.

* *Insect Life*, 11, 1889, pp. 93-103, figs. 11-15; *Report U. S. Dept. Agriculture for 1889*, p. 346.

[For a more extended notice of this insect, see *Fifth Report on the Insects of New York*, 1889, pp. 78-85; pp. 220-227 of 42d St. Mus. Rept.]

A SAW-FLY BORER IN WHEAT.

Another introduced insect pest, long known in Europe for its injuries to wheat and rye, has been brought to notice the past year. It bears abroad the common name of the "corn saw-fly," which may not be used by us as it would be misleading, since with us "corn" is applied only to the *maize* or Indian corn, while in England it is used collectively for all of the cereals or farinaceous food-plants which grow in ears, viz., wheat, rye, barley, oats, and maize. Its scientific name is *Cephus pygmeus* (Linn.).

It was discovered two years ago in (1887) infesting wheat on the Cornell University Farm, at Ithaca, where it has already become extremely abundant, but strangely, has not been observed, so far as known, elsewhere. Professor Comstock has made it the subject of a Special Bulletin—No. XI, November, 1889, in which a full account of the insect is given. The larva, hatching from the egg deposited in a slit made by the ovipositor of the female fly usually in the upper portion of the stalk, four or five days before its heading out, burrows within, working its way both upward and downward while feeding on the inner portion, and passing successively through all of the joints. Indications of its presence seldom appear before the first week in July, when it has penetrated to the first joint above the ground, at which time a discoloration beneath it may be noticed. When much of the inner portion of the straw has been eaten away, the stalk is liable to be broken and thrown to the ground by high winds that may prevail.

At the time of harvest, nearly all of the larvæ have burrowed downward to the surface of the ground, where a cell is excavated and closed at the top with borings, and a cocoon is spun of fine silk. Here, after the cutting of the grain, it remains within the stubble, hibernating in its larval stage, and not assuming its pupal form until the following spring—in March or April. Some time in May the winged insect emerges from the pupa, and appears abroad upon the wing.

Professor Comstock reports that somewhat under five per cent of the wheat straws have been found to contain the insect. He does not find its injury to be so great as reported by European writers. Careful weighing of the kernels of infested and uninfested heads, shows but a very moderate amount of difference in weight. Perhaps the rye crop might be more seriously affected by it. It is an insect that

comes to us with a bad reputation, and, therefore, effort should be made to arrest its spread. The Cornell University Station would accomplish a good work, if they would not permit us to hear of its operations beyond their own borders. The wheat stubble of their farm may, at the present time, entirely monopolize the living and unfledged material in this country.* It is thought that it may have been brought over from England in straw used for packing.

THE GYPSY MOTH.

It is of no little interest to the naturalist, when the date and locality of introduction from abroad of a species of injurious insect can be definitely ascertained, that its rate and lines of distribution may be more accurately determined, and change of habits under its new environments observed. The last half century, prior to which but little attention had been given to the study of insects in this country affords approximate data of the kind, for several of our notable insect pests. Thus, to cite a few of these: The elm-leaf beetle, *Galeruca xanthomelæna* (Schr.) was first noticed in 1838, on elms in Baltimore and its vicinity; the grain aphid, *Siphonophora avenæ* (Fabr.), probably about 1850, but not injurious until 1861; the cabbage butterfly, *Pieris rapæ* (Linn.), observed in 1858, at Quebec, Canada; the asparagus beetle, *Crioceris asparagi* (Linn.), introduced probably in 1856 or 1857, and first seen at Astoria, Long Island, in 1859; the hop-vine aphid, *Phorodon humuli* (Schrank), recorded for the first in 1862; the currant worm, *Nematus ribesii* Scop. (formerly known as *N. ventricosus* Klug), introduced about 1860, it is believed at Rochester, N. Y.; the carpet beetle, *Anthrenus scrophulariæ* (Linn.), about 1870, in New York city and in California; the clover-root borer, *Hylesinus trofolii* (Müll.) [lately referred to *Hylastinus obscurus* Marsh.], about 1875, first observed in Yates county, N. Y., in 1878; the pear midge, *Diplosis pyrivora* Riley, in 1877 or 1878, at Meriden, Conn.; the larch saw-fly, *Nematus Erichsonii* (Hartig), first seen in 1880, on imported larches, at Brookline, Mass. To the above formidable list, a score of others introduced within the period embraced, might be added, the injurious character of several of which would entitle them to special mention. I will only add to the list, at this time, by mention of, and brief reference to, one which has been brought to our notice during the past year, and which is exciting so much interest in Massachusetts that the Governor of the state has deemed it

*Publication has since been made of the capture of a single example of the species, at Ottawa, Canada, in 1887, by Mr. Harrington, and of three examples by Mr. Van Duzee, at Buffalo, on the 9th and 11th of June, 1889, showing that it has already attained a somewhat extended distribution.—(*Canadian Entomologist* for February, 1890, xxii, p. 40.)

proper, in his late message, to call public attention to it, that, if possible, it may not be permitted to extend over the state, and other states of the Union. The insect is the *Ocneria dispar* of Linnaeus, popularly known in its winged stage, as the Gypsy moth. It is an old pest of European countries—more particularly perhaps in Germany than elsewhere, where at times its caterpillar has stripped the foliage from entire forests. It is one of the kind known as polyphagous or having a great number of food-plants. Hardly any shrub or tree, whether fruit or forest or ornamental is rejected, and garden vegetables and other products are also eaten by it. It is evidently adapted to a very broad distribution, occurring as it does, throughout Europe, Northern and Western Asia, and in Japan.

It was accidentally introduced in the United States in the year 1869, by an entomologist, Mr. L. Trouvelot, then living near Glenwood, Medford, Mass., who was engaged in experiments with the production of cocoons suitable for silk manufacture, from our native silk worms and a few foreign species. From some cocoons of the Gypsy moth, brought over by him, the winged insects emerged, and a few chanced to escape. Their progeny, adapting themselves to the conditions presented, have continued to increase from that time onward, until they have become thoroughly naturalized. Fortunately, the species is single-brooded; the female does not deposit many eggs, and its heavy abdomen disinclines it to extended flight. Hence it is, that although twenty years have passed since its colonization, the area of distribution which it has appropriated and now holds, is limited to an ellipse of about a mile and a half by a half-mile in extent, in Medford—a few miles northwardly of Boston. But within this area, it appears, from the report of Professor C. H. Fernald, Entomologist of the Massachusetts Agricultural College and of the Hatch Experiment Station, to have displayed a remarkable voracity. In the Special Bulletin of the Station for November, 1889, devoted to the insect, it is said to have “multiplied to such an extent as to cause the entire destruction of the fruit crop and also to defoliate the shade trees in the infested region”—that above named. That an insect capable of such destructiveness, and with such an European history attached to it, should be promptly met and exterminated while practicable in its present limited area of occupation, will be conceded by all. It is reported by the press, that an appropriation from the state legislature has been asked for the purpose. Professor Fernald expresses his confident belief that “if every tree and shrub in the infested region in Medford be thoroughly showered with Paris green in water, soon after the hatching of the eggs in the spring, the young

caterpillars will surely be destroyed; and if any escape, it will be because of some neglect or ignorance in the use of the insecticide." He is not positive that the insects "can be exterminated in a single year, but entertains no doubt but that, if the work of showering be continued during the months of April and May for two or three years, under competent direction, that they may be entirely destroyed."*

PROGRESS IN INSECT STUDIES.

Passing now to another division of my paper, may I speak briefly of the progress being made in insect studies, particularly as they relate to the control of insect depredations.

After having been laboring for many years in a field of study in which the forms requiring investigation are far more numerous than all the other classes of the animal kingdom combined — with but few, perhaps ten or twelve, co-laborers throughout the United States, and with results not always meeting the demand from our agriculturists for aid in times of need — it affords me more gratification than I can express, to be able to report a progress in economic entomology, such as I had not dared to hope ever to see. Those of you who have had hard experience in your gardens and elsewhere in fighting some of our most common insect pests such as the wire-worm, the white-grub, the rose-bug, the cucumber-beetle, and the cabbage-worm, should also rejoice with me that these, together with many others of the kind, will in all probability, ere long, be brought under such control that serious injury from them can be prevented. Scores of enthusiastic workers are now engaged in earnest study of the successive stages in the lives of our more injurious insects, that their most vulnerable points may be learned, and in experiments which shall indicate the most simple, inexpensive and efficient method of dealing with each insect pest. No preceding year has marked so great an advance in applied entomology as has the last.

ENTOMOLOGISTS OF THE AGRICULTURAL EXPERIMENT STATIONS.

This is the direct result of the beneficent provisions of what is commonly known as the "Hatch Act" of the 49th Congress, of 1887, for the establishment of an Agricultural Experiment Station in each of the United States, to embrace those departments of investigation and experiment which will bear most directly on the agricultural industry of the respective states. Thirty of these stations

*An appropriation of \$25,000 has since been made by the Massachusetts legislature for the extermination of the moth, and three commissioners have been appointed by the Governor who have already (in March) entered upon their work. Since the above was written the insect has spread over a considerably larger territory.

have already organized a department of entomology, or of entomology and botany united — the two studies being intimately connected in the interrelation of insect injuries and plant diseases. The valuable work accomplished by these entomologists has been shown in several publications, in bulletins of the stations, etc., which have been highly creditable, and undeniably, contributions of much economic importance; and further, giving assurance of rich results to follow.

OPERATIONS AGAINST THE ROCKY MOUNTAIN LOCUST.

I can not refrain from referring, in illustration of the character and value of the work that is being done in insect warfare, by the experiment stations, to that recently conducted at the Minnesota Experiment Station, by its very able entomologist, Dr. Otto Lugger. It was an effort to save from destruction the crops of a section in Otter Tail county from the descendants of a few Rocky Mountain locusts, *Caloptenus spretus*, that had located there in 1884, and at the time that active operations against them were commenced (in 1888) had hatched in numbers sufficient, as estimated, not only to destroy the entire crops of that county but of a large portion of the state. The preceding year five thousand acres of wheat had been swept away. In this emergency appeal was made to the Governor of the state for aid. Dr. Lugger was commissioned by him to visit the locality and report upon the situation. Upon his report the Governor at once sent to the infested region the material that was asked for in sheet-iron for making large pans to contain tar and kerosene, and muslin for the construction of bags, in which to catch and kill the "hoppers." By means of these, fifty and more bushels of locusts (nearly all young and requiring at the least, seven thousand individuals to make a bushel) were caught and killed daily near Perham during a week in June. By the 1st of July, from a low estimate, twenty-five hundred bushels had been killed. The labor required was paid for by the county commissioners, with the promise of being returned by the state, which was thereafter done. Later it was determined to pay a bounty for catching and killing the hoppers, and one dollar a bushel was offered by the county commissioners. As the "hopper-dozers," the popular name for the ten-feet long sheet-iron pans which had proved so efficient, did not hold the insects that were swept into them, but allowed perhaps four-fifths of the number to jump from the oil to die thereafter on the ground, another device was resorted to. This was known as the "balloon hopper-catcher," and consisted of a frame of strips of wood, 18 feet long, to lie flat on the ground, and carrying upon it a large, loose bag of cheese-cloth, with a spout made of a sack

sewed into one corner. As this is drawn quickly over the ground by a horse, and the bag or balloon becomes inflated by the wind or draught, the "hoppers" are scooped up, or hop or fly into it. When the bag is filled, the insects are removed to other bags, in which they are tied up for convenient measurement. It worked admirably, and yielded golden returns. The fields were covered with hopper-catchers—men, women, and children—the latter using their aprons and shawls, and the women, table-cloths and sheets. The farmers gave up their usual work for this better remuneration. They would allow no one to share with them in the ingathering of this harvest, all intruders being warned away by such signs as these [posted up in conspicuous places; "All hopper-catching forbidden on these premises," or "For the privilege of hopper-catching apply to ————." The crop was undoubtedly the best paying one that their lands had ever yielded. The number of bushels caught and measured in this manner, and paid for by the commissioners, was 14,357. The nearly \$15,000 required for the purpose was considered as money well expended. At the lowest estimate, the number of bushels of locusts killed in Otter Tail county, during the season, was thirty-five thousand. The total expenditures, under the different methods employed, was \$17,757; and, the result, the crops of most of the farms were saved.

It having been found last spring (1889) that the eggs of the locusts had been mainly deposited in stubble-fields, and that in every case where such lands had been plowed, as the result of the deep burial of the eggs beneath the surface, hardly a locust had made its appearance, it was determined to plow all of the more badly infested fields, through the aid extended by the state, while continuing the use of the "hopper-dozer" on the less infested portions. All such fields as were found on examination to contain a large number of the eggs, if exceeding twenty-five acres (the smaller plots being left to the owners to plow), were condemned, and farmers living in the vicinity were invited to plow them within a given time. The plowing was to be properly done as supervised by the owner, to the depth of at least five inches, for which the laborer was entitled to draw his pay of \$1.25 per acre. This measure proved to be a complete success. No locusts hatched in the plowed fields. Where the young had emerged from the eggs, they were buried in the furrows and killed. The number of acres plowed as above, was 6,361—a trifle less than ten square miles. The entire expenditure for the season, including the "hopper-dozer" catching, burning over stubble and dead grass fields, poisoning with London purple, etc., was \$10,131.

As a result of the operations above narrated, the insect has been virtually destroyed throughout the infested districts. Comparatively few eggs were laid last year, and there is no apprehension of serious injury from the few survivors the coming season.

When you recall the fearful losses from this Rocky Mountain locusts in some of the western states in former years that brought poverty and starvation to thousands of their people—estimated at two hundred millions of dollars in a single year (1874), in the four states of Missouri, Kansas, Nebraska, and Iowa, you can not but regard it as a triumph for economic entomology, that this great scourge, almost equaling in destructiveness, in years of its abundance the migratory locust of the old world, has been brought under control.

THE ENTOMOLOGICAL DIVISION OF THE U. S. DEPARTMENT OF AGRICULTURE.

I have on many former occasions felt it my duty and privilege to mention and commend the work being done by the Entomological Division of the Department of Agriculture at Washington. It well deserves the liberal support extended to it by our General Government, and the appreciation and encouragement which it is receiving from the present Secretary and Assistant Secretary of the Department. Its studies are thorough and of great practical value. Its publications are characterized by a merit that makes them eagerly sought for by entomologists throughout the world. Its collections—remarkably rich in biological material—its manuscript and other unworked matter relating to insect lives and habits, surprise me with their amount and richness when a short time ago I was able to look over a small portion of the accumulated store.

The Division has recently achieved a signal triumph, to which there is but time merely to refer, interesting as the recital of its story at some length would be.

INTRODUCTION OF PARASITIC INSECTS.

In 1868, a scale-insect, *Icerya Purchasi*, or, as it is popularly known from its peculiar appearance, "the cottony-cushion scale," chanced to be brought into California, on an Acacia from Australia. It multiplied, spread rapidly, attacked almost every kind of vegetation, but was especially destructive to orange trees. Its increase could not be prevented by any means resorted to, although aided by all the scientific skill that could be commanded. The orange trees were killed; entire orchards were taken up and devoted to other uses. The orange culture—so important an industry of the state—was apparently doomed.

It occurred to Dr. Riley, chief of the Entomological Division, that the ravages of the insect could be staid, if the natural parasites that had kept it from being a pest in its home in Australia, could be secured, brought to California, propagated in sufficient number, and then turned loose to seek their prey. After much labor and many disappointments, a small appropriation was obtained sufficing to defray the traveling expenses of two agents of the division. They were dispatched to Australia, where they were successful in procuring some of the parasites and predaceous enemies of the *Icerya*, and in sending them alive to this country. They were carefully cared for, propagated in confinement in large number, and then distributed throughout the infested districts. One of the imported species, belonging to the family of "lady-bugs" (*Coccinellidæ*) has displayed wonderful powers of multiplication, and remarkable fitness for the work assigned it. From the 514 individuals imported last winter, in five different sendings, the present progeny may be numbered by the million.

The success of this measure has far exceeded the most sanguine expectations. It has been simply marvelous! The orange grower now points to orchards which were on the verge of ruin, where it is not easy to find a single living scale. The, perhaps, most pernicious scale-insect ever known to science, has been conquered, and seems doomed to a speedy extermination. The California fruit-growers are jubilant over the success of the first experiment of fighting an introduced pest by the importation of its natural enemies — often proposed but never before accomplished.

CULTIVATION OF INSECT DISEASES.

Considerable attention has been given by Professor Forbes and others to the contagious diseases of insects, to which some of our insect enemies have shown themselves to be quite liable. They have at times assumed an epidemic character, and have thereby proved highly beneficial in arresting serious and widespread ravages. It has been hoped that much might be accomplished by the distribution of insects infested with contagious disease to uninfested localities, and thus rapidly and greatly extend its sphere of operations. Experiments of this nature have been made the past year in Minnesota and in Kansas to utilize a fungus disease with which the chinch-bug has been recently attacked in some of the western states. In Kansas, numbers of the diseased bugs were collected, which being confined with apparently healthy ones, readily communicated their malady to them. When a sufficient quantity were obtained in this manner, distribution was made of them at various points along the railroads of

the state and other principal lines of travel. It is claimed that in almost every one of these localities the disease subsequently made its appearance, and it is believed that it was conveyed and quite largely extended through this distribution.

Lest I should weary you with details that may not be of general interest, I will not extend them, trusting that what I have already presented will suffice to show that economic entomology is not only a live science, but that it has attained a vigorous manhood, in which it is prepared to do its full share in the extension and promotion of the first and foremost of the great industries of our country—the agricultural.

LATE EXPERIENCES WITH INSECTS INJURIOUS TO THE ORCHARD AND GARDEN.

[From the Proceedings of the Western New York Horticultural Society, 1890. Read before the Society at its Annual Meeting, January 22, 1890.]

GENTLEMEN.—You will be glad to know that rapid progress is being made throughout the United States in the study of insects, particularly in that department of the science known as economic entomology, which has specially to do with our insect foes and insect friends, and how they are to be met. A great impetus has been given to the study through the establishment, in each one of the states of the Union, of an Agricultural Experiment Station, thirty of which, in consideration of the practical importance of investigation relating to insect pests, have enrolled an entomologist among their faculty. Some of these are among our most able entomologists. They have entered with ardor upon their work, and highly valuable results have been achieved. There is every prospect that within a few years nearly all of our most injurious insects will be brought under control.

The most promising feature in this “new departure” is the opportunity for experiment offered, whereby the value of any possible preventive or remedy may be tested, and any proposed remedy tried under the many modifications required by conditions of soil, climate, season, atmosphere, wet or drought, particular vegetation to be protected, etc. This recent large increase in the number of working entomologists, together with the favorable field for research and experiment presented in the farms connected with the Stations, has led to the organization during the year of an association known as the “Association of Economic Entomologists.” Its title defines its membership. Its objects, essentially, are the insuring of such co-operation among its widely distributed members as shall result in the largest possible aggregate of benefit, through the discussion of best

methods of work, the announcement of proposed studies that unnecessary duplication may be avoided, and indication of special lines of desired investigation.

I have not dared to attempt, in the few hours that I have been able to devote to this paper, to give you what I would gladly have done had time permitted—a general summary of what has been accomplished by our entomologists during the past year in their studies of methods of dealing with the insects with which you are specially interested—those of the orchard and garden, which, by the way, embrace by far the larger number of our insect enemies. I can only refer to some of the results obtained through experiment, in several instances elaborately conducted, and mention some of the insect attacks of the year which may be of interest to you.

SPRAYING OPERATIONS.

Judging from present indications, the force-pump is destined, for the future, to play a prominent part in our operations against the insects of the orchard and garden—especially those of the former. It has assumed its present importance, from studies made within the last few years in insecticides, in simple methods through improved apparatus for their easy and thorough application, and the results that follow their use. The ease with which the codling-moth can be controlled, and apples grown of full size (the elements permitting), of perfect form, rich in color, of highest flavor, and of resistance to early decay, are a sufficient attestation to its value. When we add to this, that by its aid we hope soon to be able to bid defiance to the plum curculio, and control the ravages of almost every insect that feeds upon the foliage of our fruit trees, and of a large number of those that attack the products of our gardens, I feel justified in saying that no orchardist or horticulturist can afford to do without a force-pump; it would be costly neglect. Insecticidal spraying, compared with old methods of fighting insects, as pinching by hand or distributing poisons with a sprinkling-pot, is as the Gatling gun in comparison with the old flint-lock musket.

The experiments made at the Experiment Stations show conclusively that in spraying with the arsenical poisons, much stronger mixtures have been used than are necessary, and that in no case need they exceed the strength of one pound of the arsenite to 200 gallons of water. As the foliage of fruit trees has at times been injured to a greater or less extent by the insecticides employed, it is very desirable that the minimum amount of the arsenite should be used that will suffice for its purpose. Experiments for determining this will be a portion of the work for the present year. It would seem that the

arsenities are more liable to injure the foliage when it is more advanced than when it first puts forth. If this shall be established, later sprayings should be of reduced strength.

The different fruit trees show different degrees of susceptibility to the poisons. It appears that the apple and cherry are the least affected, the plum is more susceptible, and the peach the most readily injured. For plum trees one pound of the arsenite to 250 or 300 gallons of water should be used, while for the peach, a dilution to at least 300 gallons [for Paris green, and 400 gallons for London purple] is recommended. It is probable that further experiments will show that while Paris green is preferable for use on one or more of the fruit trees, London purple is less harmful to others, and the reverse.

Different results with reference to injury to foliage have been obtained through spraying at different hours of the day, and under different atmospheric conditions.

Although there has been some conflicting testimony, it would seem that white arsenic may not be used with safety, and certainly not when it has been dissolved by boiling or otherwise.

SPRAYING WITH WATER.

With merely mentioning, in passing, other principal insecticidal liquids that are employed in spraying, such as kerosene emulsions, alkaline solutions, pyrethrum water, tobacco water—each of which has certain adaptation to certain insect attacks, I will ask your attention to a method that has been brought to our notice within the past year as having proved efficient in arresting the injuries of one of the chief pests of rose-growers—the rose-slug, *Monostegia rosæ* (Harris). We are indebted for it to Mr. L. O. Howard, first assistant of the entomological division at Washington. I quote a communication recently made by him to *Orchard and Garden*.

I enjoyed fighting the rose-slugs in my garden last summer, particularly as they were so easy to kill. It was an old garden with many varieties of roses. During the early summer there was abundant rain and I did not bother myself one way or the other about the plants, as they bloomed plentifully and looked green. But when a dry spell came, the leaves turned brown at once, and an examination showed them to be covered with slugs of all stages of growth. I sprayed them with a tobacco-soap solution which killed them at once, but stained all the petals brown at the tips. I puffed on pyrethrum mixed with spoiled flour, which also killed them, but pyrethrum is rather expensive. I dusted them with sifted coal ashes, which also killed them, but it made the bushes look nasty. As the drought continued I brought out my hose, and discovered, to my delight, that a strong stream of water directed on the foliage each evening was the most efficacious and the neatest remedy that I had yet found. During the remainder

of the season the bushes were green and beautiful, and free from slugs. This strong stream of water I found was a most admirable thing. It blew the plant-lice off my currant bushes; it thoroughly discouraged the web-worm on my shade trees; it made the little ants which build their little mounds on my lawn and in the cracks of my brick wall, tired of life; and, best of all, it broke up the nests and completely disheartened the English sparrows which built in the ivy and over the windows of my house. Where it is available, therefore, pure water, "without trimmings," when thrown with a sufficient force, is a good insecticide.

I would heartily indorse the above communication of Mr. Howard. I have every confidence that a rather coarse spray of water thrown with force will serve to rid us of the injuries of many other pests than those above named. It will be efficient against the little white rose-leaf hopper—probably the *Tettigonia rosæ* of Harris (which, as Mr. Uhler has informed me, belongs to the genus *Anomia*, and is distinct from the European *rosæ*). It should also be equally efficient against the several species of small leaf-hoppers, *Erythroneura vitis*, and others, that infest the grapevine, particularly if employed against them in the early larval stages. It should be destructive to all of the plant-lice that can be directly reached by the spray. The efficiency of rains in arresting attacks of the apple-tree aphis and the hop-vine aphis has long been known. If these delicate insects can be knocked from their food-plant while their beak is inserted into it, the smallest portion of the tip of the beak left behind them in the plant would prevent further feeding and necessarily prove fatal to them.

FUNGICIDES AND INSECTICIDES COMBINED.

The multiplication and extension within a few years of plant diseases, which have been ascribed to high culture, large production, and extended areas devoted to special crops, have rendered it necessary that these, as well as insect ravages, should enlist the attention of, and be earnestly fought by, the horticulturist. Many of these diseases among those which are of a fungoid nature, promise to be controlled, if not conquered, by the use of the Bordeaux mixture.* If the fungi and the insects could be simultaneously controlled, it is evident that time, labor, and expense would be saved. The advantage resulting from combining London purple with Bordeaux mixture in killing the Colorado potato-bug and preventing the potato rot, has been shown in experiments made; and there is every reason to believe that other insects and other fungoid attacks may be similarly treated with great success.

*Of the different formulæ for this, perhaps the best is: Six pounds of sulphate of copper dissolved in 4 gallons of hot water; 4 pounds of lime dissolved in 4 gallons of cold water; mix and dilute with cold water to 22 gallons.

CARBOLIZED PLASTER PREVENTIVE.

Plaster of Paris has frequently been used to prevent insect depredation, but it is doubtful if it would be more efficacious for this purpose, when applied to fruit trees, than ashes or road dust. From some experiments in protecting plum trees from curculio attack, carbolized plaster, made by combining one pint of crude carbolic acid with fifty pounds of plaster, has shown such beneficial results that the method merits additional trials. It may prove a valuable preventive of the depredations of the rose-bug, *Macrodactylus subspinosus*, from which, as yet, we know of no satisfactory means of protection.

STUDY OF THE ROSE-BUG.

The recent working out of the life-history of this great pest of the fruit-grower and florist, by the Entomological Division at Washington, will, it is hoped, when published, aid materially in operations against it; but I have long thought that our best success in contending with it is to be found in the study of its particular breeding grounds. It is known to be a local insect, appearing suddenly in immense numbers, in particular localities only, and there is, therefore, reason to believe that it has its particular breeding grounds. In one instance, at least, such a source for it has been known and observed for many years. Mrs. Lucy G. Chrisman, of Chrisman, Va., with whom I have exchanged several letters on the subject, informs me that year after year the rose-bugs may be seen coming in myriads from a bush-covered, swampy or marshy soil, of sand that is always wet, and which had, evidently, in former years, been a bend in the river, now cut off by a change in the channel. They are annually true to their appointed time of appearance almost to a day, and true also to their line of flight, which she has kindly mapped out for me, and represents as being in a body about five hundred feet broad, moving up the old river bed the first day as far as a church indicated in her sketch, about a mile from the swamp, and flying quite low. The second day they rise higher in their continued flight, spreading somewhat, and reaching certain points beyond (indicated) in one, two and three days thereafter. I hope, later, to compile from Mrs. Chrisman's letters the interesting observations made by her and gathered from her friends, of the breeding ground, flight, limitation to sandy soil, feeding and other habits, which she has very kindly given to me. [*]

In the necessarily hurried preparation of my Annual Report for the last year, which was handed in for printing in December last,

[* An admirable study of the Rose-bug has since been made by Prof. Jno. B. Smith, of the New Jersey Agricultural College Experiment Station, which has been published as Bulletin No. 82, July, 1891, of that station: pp. 40, figs. 10.]

several of the insect attacks of the year, to which I had given attention, were not mentioned. May I briefly refer to a few of them here. They will be mainly of fruit insects.

COLEOPHORA SP.—A NEW PEAR INSECT.

On June 8, 1888, Mr. P. Barry reported to me that the newly-set pears of the Mount Hope Nurseries had been vigorously attacked by a new enemy, a queer-looking form, which was found with one end inserted into the fruit. Examples were subsequently sent, when the depredator was found to be the larvæ of a small Tineid moth, of the group known as "case-bearers," from the small case which they construct for their covering while in the caterpillar and pupal stages — sometimes cylindrical, sometimes ellipsoidal with a smooth or ridged surface, in others horn-shaped, and indeed, assuming various forms. The case is never deserted by the larva, but is carried about upon its body, thrusting out its head to feed, and in this instance burying its head and front segments into the fruit, with the case projecting therefrom and appearing as if a small twig had been stuck into the pear.

Specimens of the fruit submitted showed that the operations of the caterpillar consisted in boring numerous round holes of about the diameter of its body (that of an ordinary pin) to the depth that it could protrude from its case. Withdrawing itself, it would remove a space and again burrow into the fruit. Many of these holes had been made in each pear. One of the pears received, of only one-half inch in diameter, showed, by count, forty-four of the borings. The necessary result of such an attack was the destruction of the fruit, it becoming with its growth gnarled and wholly unfit for use.

The detection of this attack is undoubtedly the explanation of many of the scars and unsightly deformations of apples and pears, which, from the entirely different character presented at a later stage of growth, had long been a perplexing mystery to me, not being able to refer it to any known insect. A month later, July 9, some Duchesse pears, of about an inch and one-fourth in diameter, were received from J. F. Rose, of South Byron, N. Y., which were sent as a sample of his crop, which had been rendered worthless from its scarred and gnarled condition. I recognized the injury as having been caused by the *Coleophora*. Some of the spots retained their original round form, while others had become elongated, triangular, lozenge-shaped, or of irregular forms, as the result of the growth of the fruit. The margins of the scars were blackened, elevated, and the somewhat enlarged interior contained pale, yellowish, granulated matter. From twenty to thirty

of the scars occurred on each pear, and several of the same character on the stems.[*]

It is quite probable that this *Coleophora* attack will prove to be widespread and the cause of injury frequently observed but not hitherto traced to its source from the early period at which it is made. The insect seems to belong to the genus *Coleophora*. The species has not yet been determined. From the half-dozen cases sent me, two of the insects were successfully carried to their perfect stage, and are now in the State collection. The larvæ ceased feeding and fastened their cases on end to the bottom of the box containing them on June 13th. The first moth emerged twelve days thereafter, and the second on July 7th.

Should the insect appear in injurious numbers hereafter, it could be destroyed by spraying with an arsenite soon after the setting of the young fruit.

THE PEAR-BLIGHT BEETLE.

The "pear-blight beetle," *Xyleborus pyri* (Peck) appeared in great abundance in a pear orchard of Mr. Norman Pomroy, of Lockport, N. Y., in the spring of 1888, where its operations were so severe that the orchard consisting of young trees, was nearly ruined by it. The attack had assumed a different character from that usually ascribed to it, for instead of the burrows of the insect running upward or downward, in this they were mainly horizontal, and carried around the trunks or limbs of the young nursery stock so as to nearly girdle them and permit of their being easily broken off by hand. All of the trees attacked were killed, and were either pulled up when they were seen to be dying, or sawn off below the lowest burrows, which in many cases was near to the ground. These latter, subsequently made a vigorous and healthy growth. The injuries of this beetle have long been known, but thus far we have been without its life-history. Nothing, so far as I know, has been published of its early stages. As Mr. Pomroy who kindly sent me some of the infested material from Lockport, claims to have seen the insect in its egg and young stages, I extract portions of his letter, containing also, interesting notes of habit, that they may be compared with observations of others that will be made hereafter.

Writing under date of June 5th, 1888, he states: "I find by close inspection, the eggs as well as the young. By cutting carefully into the burrow the bottom of the hole is found to be full of eggs and young ones." Under date of June 13th, the following: "When the

[*A portion of this injury, it was subsequently learned, was inflicted by one of the plant-bugs, *Lygus invitus* Say, as will be related in the Report of the Entomologist for the year 1891.]

trees were seen to be dying and I commenced to pull them up (presumably about the middle of May, when inquiry was first made of the insect), the ground beneath was noticed to be covered with sawdust, and examining for the cause I found the trees full of holes. Sitting down and watching the holes I saw the dust dropping out of them. I only saw one of the beetles out of the holes and that was walking around on the tree. At the bottom of the holes they have made a side-cut and lined it with a white substance for their young to eat. If you take your knife you will find this side-cut and the eggs, if they have not hatched; if they have, then the young will be there. Professor Lewis of the Union School examined a limb and found the side-cut full of eggs.

"I send a short piece of the body of a tree, that you may see that they like the trunk as well as the limbs.

"The tree leafed out, but in a few days the leaves wilted. I carried a couple of the trees to the Farmers' meeting at Cambria Center, which was held a day or two after I found the insects in them." (The meeting was on May 25th.)

I am sorry to have to state that pressing engagements prevented my examination of the infested material sent me, and the opportunity for examining the eggs, if present, and the young and their feeding habits was lost. There must, however, have been some error in the observations as reported to me, for instead of the young beetles occurring in association with the eggs, it should have been the larvæ—or grubs, as generally known. Possibly the pupæ may have been mistaken for eggs.

In the latter part of September—26th—there were discovered upon the hearth-tiles of my office, where the bundle of infested branches had been placed at the time of its reception, a number of beetles that had emerged—ten males and ten females, most of which were alive. Cutting into a few of the burrows, some of them disclosed the peculiar white lining above referred to, but no living presence. A few words in reference to this white substance: It was of a yellowish-white color, solid, exceeding in thickness that of an ordinary sheet of writing paper, rather smooth when apparently undisturbed, but quite roughened where it had probably been more or less eaten. In a letter recently received from Miss Ormerod, the accomplished entomologist of the Royal Agricultural Society of England, in mentioning serious ravages on plum trees in England during the past year from *Xyleborus dispar*—possibly identical with our *X. pyri* [*]—Schmidberger is

[*It has since been ascertained that the two are identical, and the name of *pyri* will have to give way to the earlier one of *dispar*.]

quoted as of the opinion that the larvæ of this species feed on a whitish substance in the mother galleries. Miss Ormerod had observed the white linings in the tunnels of the *X. dispar*, but it seemed to her to be a mould, such as other observers have thought to have noticed in the galleries of Coleopterous larvæ allied to *dispar*, and on which they apparently fed. The limited observations that I have made, lead me to believe that further examination and study will show it to be a special secretion by the female or the parents, to serve as food for the young, and that it constitutes the only food of the larvæ, living as they do within chambers excavated for them, and not tunnelling separate galleries.

At the time above mentioned the burrowed branches were cut in pieces and inclosed in a case to secure such beetles as might thereafter emerge. On December 18th, following, I took from the case 33 male beetles and 293 female — all dead; December 24, ten females — one alive; February 11, 1889, 18 females — all dead and the last to emerge. The material is retained for further study of the burrows.

The above recital well illustrates how much there is still to be learned of our common insects, and may also serve as an apology for the entomologist's inability at times to offer remedies for their ravages. This "pear-blight beetle," destructive also at times to apple, plum, and apricot stock, was described and its operations observed as long ago as the year 1817, and has since been frequently written of; but up to the present day it has succeeded in concealing its early stages from us. Still more strangely, the male sex of the species had never been recognized or known to science until found by me among the large number of beetles reared from the Lockport pear trees.[*] Another species, *Xyleborus obesus* of LeConte, had been thought by Schwarz and others to be the male of *X. pyri*, but it now proves to be quite distinct. The two sexes differ so markedly that they may be separated at a glance without the chance of error. The abdomen of the male is only about one-half so long as that of the female, its thorax is less rounded and elevated, and the head is porrected (bent downward), at least after death, so as to form quite a curve with the body. Examples of the male have been contributed to the cabinet of our principal Coleopterists, and others will be sent to those who value them.

Since the above was penned, Mr. Pomroy has written me in reply to inquiries made, that the "young" to which he referred were the young grubs of the beetles. He commenced to find the grubs and the eggs

[* This requires correction. *X. dispar* had been known in Europe for many years, in its early stages and in both sexes. The rarity of the male had often been stated.]

about the first of June. [Probably he did not look for them earlier.] The eggs were quite small, of a whitish color, standing on end side by side to the number of six to eight, in a side chamber. A magnifying glass was used in their discovery. As near as he could determine by the aid of the glass at his command, the grubs were feeding and living on the white substance lining the chambers.

A NEW DEPREDATOR ON QUINCE BLOSSOMS.

From Mr. A. H. Briggs, of Macedon, examples of a species of snapping-beetle were received on the 20th of May, 1889, which, during the preceding four years, had been so abundant and injurious to the blossoms of his quince trees that he had been obliged to go over the trees daily and knock the beetles into a pan of kerosene and water. "From three small bushes frequently a hundred would be taken, and often five or six would be working into the heart of one bud, and apparently fighting one another in their eagerness to enter it. Their attack usually began before the blossom-bud had opened, or immediately thereafter, and continued until it was destroyed." Until the present year, when the insect was less numerous than heretofore, he had been able to save but few buds from its attack. The same insect had made its demonstrations on the trees of Rev. Dr. Jacques, while four years previously residing at Macedon Center, and had been fought by him with Paris green mixed with flour.

My identification of the beetle as *Limonius confusus* LeConte, was subsequently confirmed by Dr. Horn; but the injury to the blossoms reported of it was questioned, and further examination asked for. Upon submitting the doubt to Mr. Briggs, answer was returned that there was no possibility of a mistake, as he had often watched their feeding, and that those sent me had been taken by him from the blossoms while eating the petals. Dr. Horn entertained the opinion that many of the Elaters (snapping beetles), were predaceous in their final winged stage, although vegetarians as larvæ. While he had recorded *Limonius 4-maculatus* from the blossoms of *Æsculus*, he was not aware that they fed on the flowers — possibly on insects within them.[*]

THE PEACH-BARK BORER.

Some small bark-boring beetles were received October nineteenth from David Huntington, of Somerset, Niagara county, N. Y., taken from the bark of a peach tree affected with "the yellows," accompanied with the inquiry of name — if they caused the yellows, and

[* Prof. F. M. Webster has observed *Limonius auripilis* Say feeding upon ripe raspberries in the month of July. *Insect Life*, ii. 1889, p. 258.]

the remedy for their attack. Reply was made that they were a species of the Scolytid bark-borers, known as *Phloeotribus liminaris* (Harris). In writings upon it, it has been given the common name of "the elm-bark beetle;" but it has been recently ascertained that it does not infest the elm, but that another form closely resembling it, viz., *Hylesinus opaculus* Lec., had been mistaken for it. It is a well-known pest of peach trees, and was formerly supposed to be the cause of "the yellows;" but its only connection with it is that it is frequently found in trees that have become weakened and sickly through the disease. All of these Scolytid bark-borers, from their concealment and habits, are difficult to reach and kill, and we know of no satisfactory methods at present of dealing with them. Whenever a tree has become badly infested, it should be promptly taken up and burned. I have requested of our State Station at Geneva that experiments be made in the application of kerosene to the trunks and limbs of trees, at different seasons of the year, to see if it may be done with safety. If it shall be found that kerosene—one of our most efficient insecticides—may be freely applied without harm to the tree, then I trust that we shall be able to kill the bark-borers in whatever stage they may be occurring within or beneath the bark.

This insect seems to be increasing in the State of New York. Some notes upon it, descriptive of its galleries, etc., may be found in the *Fourth Report on the Insects of New York*, 1888.

THE CHERRY-TREE SLUG.

The cherry-tree slug, *Eriocampa cerasi* (Peck), has, during the last year, and for several preceding years, been very prevalent and injurious at, and in the vicinity of, West Farms, N. Y. As reported by Mr. James Angus, the foliage has been so riddled by the feeding of the well-known brown, slimy, slug-like larva, that a perfect leaf could with difficulty be found. There is no need of injury such as the above, for the larva can be readily destroyed by spraying with hellebore in water—an ounce of the powder to two gallons of water—or by dusting the foliage with fresh air-slaked lime.

THE CURRANT-STEM GIRDLER.

The operations of this insect are recorded in my *Fourth Report* (page 47), as follows: "A short distance below one of the larger leaves of a tip, five or six sharp, somewhat curved cuts could be seen, encircling the stalk, and from their depth, nearly severing it, causing the tip to fall over and hang by only some small points of attachment. Later the tip breaks off and falls to the ground. The attack, while allied to that of the raspberry-stem girdler, is quite distinct."

I have not been able to find the author of this, apparently, new form of injury. Mr. A. H. Briggs, of Macedon, N. Y., has kindly sent me pieces of currant-stems thought to have been girdled by the insect and to contain the larva, but I was unable to find any living form within them.

THE GRAPEVINE FLEA-BEETLE.

An unusual number of inquiries have been received during the spring and summer of 'the grapevine flea-beetle, *Haltica chalybea* Illig. Either the conditions have been more favorable for it, or it is becoming a more formidable pest of our grape-growers. Wherever it makes its appearance effort should be made to destroy the beetles during their hibernation, by burning or removing their ordinary winter quarters, as in the rubbish of the vineyards or the loose bark of the posts. In the early spring, when they first make their attack on the buds to which they are so destructive, they should be knocked off daily into a pan of water and kerosene, or jarred to the ground and crushed, or a poisonous liquid applied to the buds. The ravages of the larvæ, at a later period, may be controlled by Paris green. [In the accompanying figure, the larvæ and the beetles are represented in their natural sizes, feeding upon a twig of grapevine.] Mr. George C. Snow, of Penn Yan, N. Y., has sent me an insect which he detected preying upon the larva by sucking its juices. They were Hemipterous, belonging to the plant bugs, of which so many are known to be valuable aids to us in the destruction of our insect foes. As I could not recognize it in its pupal stage in which it was received (June 26th), it was submitted to Mr. Uhler, and was referred by him to the genus *Podisus*, and probably of the species *modestus* (Dallas).



FIG. 40.—The larvæ and the adults of the grapevine beetle *HALTICA CHALYBEA* operating on grapevine leaves.

A NEW ROSE PEST.

A destructive borer of the tips of rose bushes has made its appearance at Ausable Forks, N. Y., during the past summer, which has only been observed in its larval stage, and therefore can not be named at present. It apparently belongs to the *Tenthredinidae*, or saw-flies. Its form of injury is to commence at the extreme tip and burrow downward several inches, consuming the entire interior of the stem. Some of the infested tips were sent to me during the month of June, and were inserted in damp sand for maturing the larvæ which they might contain. On June twenty-seventh, two had completed their growth and burrowed into the sand, where they have formed cocoons of the general shape of those of the currant-worm, and measuring four-tenths of an inch in length; but it is quite doubtful if they can be carried through to their perfect stage, as hibernating larvæ of the saw-flies are difficult to rear.

The lady sending them has written: "About twenty years ago my garden roses were infested by this same borer. I fought them with knife and fire for four or five years, and rid myself of them entirely, and had never seen one since until this year. I have not been able to find a fly or a beetle on the bushes uncommon enough to think it the cause. As yet, tea and green-house roses in open ground are exempt."

Mention is made of the above, and of the other attacks, the authors of which are unknown, in the hope that whenever they may come under observation the opportunity will be embraced to give them such study as will lead to their identification and a knowledge of their entire history, that we may know how to deal with them.

VARIOUS ATTACKS OF FRUIT INSECTS.

Several other attacks have come to my knowledge during the past year, to which there is no time to refer at length, but which deserve to be put on record.

The Apple-leaf Bucculatrix.—This, at times, destructive insect, known to science as *Bucculatrix pomifoliella* Clemens (see *First Report on the Insects of New York*, 1882, pp. 157-167), which seems to display a partiality for the orchards of western and central New York, has attacked the trees of W. J. Strickland, of Albion, Orleans county, N. Y. Twigs infested with the cocoons were sent to me October twenty-fifth.

The Apple-leaf Miner.—The larvæ of the apple-leaf miner, *Tischeria malifoliella* Clemens, actively engaged in running their curious mines within the leaves of apple-trees on the grounds of State Botanist

Peck, at Menands, Albany county, N. Y., were received on September tenth. By holding to the light, the little caterpillar was plainly to be seen actively mining within. The blotches made by them appeared of a brick-red color, on the upper side of the leaves.

The Hickory Tussock Caterpillar.—From Pawling, Dutchess county, N. Y., Mr. Ira W. Hoag sent a colony of the young larvæ of the hickory tussock, *Halisidota caryæ* (Harris), taken from a cherry tree. They also occurred on several of his apple and pear trees. From a small pear tree "nearly a pint" (many hundreds at their then small size)* was taken. When disturbed they dropped by a thread and hung suspended. Shaken upon a sheet their quickness of motion made them difficult to kill. (They could easily have been destroyed by first saturating the sheet with kerosene.) This insect has not been recorded as a pest of fruit trees, having usually been confined to forest and shade trees, as walnut, butternut, elm, and ash.

The Oblique-banded Leaf-roller.—Serious injury was inflicted in a pear-block at Seneca Falls, N. Y., during the month of May, to certain varieties of pears, by a small caterpillar eating into and destroying the buds, and later, by spinning together, and feeding on, the young leaves. It had prevailed for a few years preceding. The larvæ sent to me were those of one of the Tortricid moths, and apparently that of *Caccecia rosaceana*, but I was not successful in obtaining the moth for positive identification. This species—"the oblique-banded leaf-roller"—is a common pest of our fruit trees, roses, strawberry, and a number of other trees, shrubs and plants. The remedy for it would be spraying with an arsenical liquid at its earliest attack upon the buds, before it conceals itself among the leaves.

The Eye-spotted Bud-moth.—Pieces of the new growth of plum trees were sent, June fourteenth, from the nurseries of T. C. Maxwell & Bros., at Geneva, burrowed into by a small caterpillar, which is believed to be that of *Tmetocera ocellana* (Schiff), although the larva may not properly be described as cylindrical, its head being about one-third the diameter of the body, and the central segments the broadest. In two of the tips examined the larva had burrowed just at the commencement of the new growth upward for about a half-inch, and in another, at the extreme tip from the terminal leaves downward for more than an inch. The lower burrows were filled with gum—the upper one with rounded pellets of excrementa.

The V-shaped Tortrix.—Young pears, into which large holes had been eaten, even extending into the seeds, and in some of the examples embracing nearly one-half of the pear, were received, together with the caterpillar feeding upon them, June thirteenth, from Mr. P. Barry,

of Rochester. The caterpillar changed to a pupa within the leaves of the pear, and on June twenty-fifth gave out the moth, which proved to be *Cacaecia argyrospila* (Walker) — the *Tortrix furvana* of some authors, and the *T. V-signata* of Packard, whence we have the common name above given. It is reported as having been bred from rose, apple, hickory, oak, maple, elm, and cherry. It has not been recorded previously from the pear.

A New Enemy of the Currant-worm.—A large plant-bug was discovered by Mr. Samuel G. Love, of Jamestown, N. Y., with its beak inserted into currant-worms *Nematus ventricosus*, sucking out their juices and killing numbers of them. When received by me, they were in their pupal form. They were fed on currant-worms until they transformed to the perfect stage, permitting of their identification as *Podisus cynicus* (Say), after which they were released to feed at large, in the hope that their progeny in coming years would inherit a special fondness for the food of their ancestors, and thus aid in the work of bringing under control that annoying garden pest, the introduction of which into this country from its native home in Europe, it is said, is chargeable upon a prominent member of the Western New York Horticultural Society. But this was in the infancy of your Society, and we trust that since then—during a term of years exceeding the average length of human life—you have accomplished sufficient good to atone, over and over again, for the commission of so great an evil—innocently done. Enterprise often leads us into danger and harm.

(C)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year 1890—sixty-one are named—giving title, place and time of publication, and a summary of contents. A similar list for the years 1878 and 1879 is appended:

Gypsy Moth in Medford; Mass.* (Country Gentleman, for January, 23, 1890, lv, p. 69, c. 2, 3—26 cm.)

As comment on a notice in the New York World on the introduction in Medford of the European gypsy moth, *Ocneria dispar*, and the alarm occasioned by it—opinion is expressed, that even if it should become widespread, it will not “cause more havoc than the Colorado potato-beetle,” based on reasons given. Prompt and energetic action should, however, be taken to arrest its spread, and exterminate it in its present limited locality, through measures recommended in a late Bulletin of the Hatch Experiment Station, by Professor Fernald.

[See pp. 302-304 of this Report.]

Insect Pests of the State [of New York]. (Albany Evening Journal, for January 23, 1890, xxxiv, p. 3, c. 4—12 cm.)

In an extract from an address before the Albany Farmers' Institute, held the above date, the operations of the grain aphid, the hop aphid, fruit insects, shade tree defoliators, the grapevine flea-beetle, and other insect pests of the past year, are noticed.

Mites Infesting Smoked Meats. (Orange Judd Farmer, for January 25, 1890, vii, p. 63, c. 1, 2—20 cm.)

Mites infesting smoked hams in a provision house in New York city were identified as *Tyroglyphus siro*. The meat had probably become infested in a western packing-house whence they came. Dipping in a bath of one part of carbolic acid to one hundred parts of water, recommended for destroying the mites.

[See *Fifth Report on the Insects of New York*, 1889, pp. [149]–[151].

Useful Insects. (Country Gentleman, for February 27, 1890, lv, p. 170, c. 3—8 cm.)

Insect eggs from Waverly Mills, S. C., “occurring in numbers on pear trees,” are those of the Carolina Mantis, also known as the praying

*The capitalizing of the *Country Gentleman* is retained herein, in the citation from it of titles of publication.

Mantis. Its eggs should not be destroyed, as the insect is carnivorous and consumes many injurious insects. A packet from a plum tree, also sent, is composed of the cocoons of a species of *Microgaster*, which is another useful insect.

A Singular Fly. (New York Times, for April 14, 1890, p. 5, c. 2—12 cm. Albany Daily Press and Knickerbocker, for April 15, 1890. Plattsburgh [N. Y.] Morning Telegram, for April 23, 1890.)

Examples of a small fly received from a lady (Mrs. H. D. Graves) in Ausable Forks, N. Y., are recognized as *Chloropisca prolifica* Osten Sacken. They entered the house in September, 1889, and are now appearing in one of the rooms by thousands. They were first observed eight years ago, and have annually appeared since then in August. This is the third known instance of the fly infesting dwelling-houses, the other two being at Franklin, N. H., and Alfred Center, N. Y. Reference is made to similar gatherings of allied species in European countries.

[See extended notice in pp. 234-241 of this Report.]

Fighting the Insect Pests. (Albany Evening Journal, for April 16, 1890—44 cm.)

Report of a paper read before the Albany Institute, April 15, 1890, noticing: hopeful progress in the study and work of economic entomology; the grain weevil and hop aphid; the chinch-bug; the gypsy-moth; the cow-horn fly; insecticides and the protection of crops; importation and propagation of insect parasites; an example of practical work; diffusion of insect diseases, etc.

Late Experiences with Insects Injurious to the Orchard and Garden. [Read before the Western New York Horticultural Society, at its Annual Meeting, January 22, 1890.] (Proceedings of the Western New York Horticultural Society, at its Thirty-fifth Annual Meeting, January 22, 23, 1890, pp. 16-35.) Also, in separates, pp. 20 [April 22, 1890].

Treats of: Spraying with arsenites, and with water only: Insecticides and Fungicides combined: Carbolic plaster preventive: Study of the rose-bug: *Coleophora* sp. as a new pear insect: the "pear-blight" beetle: a new depredator on quince blossoms: the peach-bark borer: the cherry-tree slug: the currant-stem girdler: the grapevine flea-beetle; and various attacks of other fruit insects.

[See pages 342-356 of the present Report.]

Spraying for the Curculio. (Country Gentleman, for April 24, 1890, lv, p. 329, c. 1-2—22 cm.)

Spraying would be effective even before the falling of the blossoms—on the first appearance of the insect abroad. London purple spraying last

year was often followed by badly affected foliage, owing in many cases to plant diseases and not to the arsenite. Paris green growing in popular favor. Importance of continual agitation of the Paris green mixture. Strength in which it may be used upon different trees.

[See pages 290-292 of this Report.]

Apple-Tree Insects. (Country Gentleman, for April 24, 1890, lv, p. 329, c. 2—12 cm.)

Cocoons of the apple-leaf Bucculatrix, *Bucculatrix pomifoliella* Clemens, containing the pupæ, are identified from [Canastota] Madison county, N. Y.; also the eggs of the apple-tree tent-caterpillar, *Clisiocampa Americana*, from which the caterpillars are hatching. The remedies for these two orchard pests are given.

Poisoning Insects. (Country Gentleman, for May 1, 1890, lv, p. 347—10 cm.)

Directions are given for mixing Paris green and London purple in water for spraying purposes, and strength in which they may be safely used. Importance of thorough mixture by constant agitation, as shown in experiment made with its rapidity of settling when at rest.

[See pages 292, 293 of this report.]

The Fly *Chloropisca Prolifica*. (Country Gentleman, for May 1, 1890, lv, p. 349, c. 2, 3—42 cm.)

Observations on the habits of the fly at Ausable Forks, N. Y., made by a correspondent [Mrs. H. D. Graves]. Effort being made to rear it on grass sod. Notices of its occurrence at Franklin, N. H., and at Alfred Center, N. Y. Its European gatherings and particularly in the Observatory at Warsaw, Russia. The chief points of interest in the insect. A brief description, that it may be recognized, if seen elsewhere.

The Voracity of the Silkworm. (Albany Times, for May 8, 1890, p. 2, c. 3—9 cm.)

In reply to inquiry made by the Times editor of the truth of a paragraph which is going the rounds of the press, to the effect that the silkworm when first hatched only weighs one-fourth of an ounce, yet during its life of thirty-five days consumes between 3,000 and 4,000 pounds of leaves!—a gross misstatement is shown, in that the silkworm just from the egg weighs but the *one-hundredth part* of a grain, and its entire food is less than a half-ounce of leaves.

Spraying for Fruit Tree Insects. (Country Gentleman, for May 22, 1890, lv, p. 407, c. 4—22 cm.)

Inquiry is made for an insecticide that may be used in a vegetable garden against the various fruit tree insects, where it is thought that the arsenites might not be safe. In reply: The arsenites may be used without danger if not in overstrength (1 to 250), and only in a sufficient

quantly; they alone, are efficient against the codling-moth worm; for many other insects, kerosene emulsion and pyrethrum water will answer. Remarks on use of cold water for spraying.

Eggs in Plum Twig. (Country Gentleman, for May 22, 1890, lv, p. 407, c. 4 — 6 cm.)

A deposit of eggs, received from Dey's Landing, N. Y., inserted in a row about a half-inch long, and disclosed to view by the splitting of the bark, are doubtless those of some "tree-hopper," allied to *Ceresa bubalus*, but are not recognized. No description of them is found. Have been tied to a plum tree in the hope that they may be reared. [They failed to develop.]

The Australian Lady Bug. (New York Times, for May 23, 1890.)

Examples of *Vedalia cardinalis*, the *Icerya* scale parasite, added to the State collection. Its extermination of the *Icerya* scale. Proposition to experiment with it for destroying the maple tree scale, so abundant in New York.

[The Eye-spotted Bud-moth.] (Albany Evening Journal, for May 28, 1890, p. 6, c. 2 — 6 cm.)

The caterpillars of this insect are occasioning much damage in the apple orchards of New York, and its injuries are apparently on the increase. The proper remedy is spraying with Paris green or London purple at the first appearance of the blossoms or earlier.

Wire-worms on Cabbage. (Country Gentleman, for June 5, 1890, lv, p. 450, c. 4 — 13 cm.)

The thirteen wire-worms taken from one cabbage at Metuchen, N. J., are probably of the genus *Melanotus*. For information of, and remedies for, these insects, reference is made to the Country Gentleman, for November 29, 1888, p. 893, where other references are given.

Insect Strawberry Pests. (New England Farmer, for June 4, 1890, p. 1, c. 1 — 11 cm.)

A beetle devouring the foliage of strawberry plants in localities in Massachusetts is identified as *Paria aterrima* Oliv. Its history, from its first public notice in 1873, is given — reference to its literature and brief description. Associated with the above was a snout beetle, identified as *Otiorhynchus ovatus* (Linn.), which may probably be added to the list of forty-two species of strawberry insects previously recorded.

Grain Aphis. (Country Gentleman, for June 12, 1890, lv, p. 470, c. 3 — 12 cm.)

Replying to inquiry of an insect on rye, at Ridgewood, N. Y., which is *Siphonophora avenæ* (Fabr.), no method is known by which to arrest a serious grain attack. Prof. Smith's recommendation of spraying with kerosene emulsion is referred to. Its usual parasitic attack in June may check it, as would also heavy rains.

Coleophora sp.—A New Pear Insect. (Popular Gardening, for June, 1890, v, p. 198, c. 1, 2—7 cm.)

Young pears in the Mt. Hope Nurseries at Rochester, N. Y., are attacked by a small case-bearing caterpillar which eats numerous round holes of the diameter of the case into the fruit and badly injures it in its subsequent growth. Early arsenical spraying would doubtless prevent the injury.

[See page 347 of this Report.]

The Pear-blight beetle. (Popular Gardening, for June, 1890, v, p. 198, c. 2—6 cm.)

Notifies the attack of *Nyleborus pyri* in a pear orchard at Lockport, N. Y., in the spring of 1888, and the injury inflicted.

[See page 348 of this Report.]

Quince Blossoms Beetle. (Popular Gardening, for June, 1890, v, p. 198, c. 2—4 cm.)

A snapping-beetle [*Limonius confusus*] proved quite destructive to quince blossoms in the spring of 1889, at Macedon, N. Y., and had been injurious for the preceding four years.

[See page 351 of this Report.]

The Peach Bark Borer. (Popular Gardening, for June, 1890, v, p. 198, c. 2—3 cm.)

No preventive of the attack of this Scolytid borer (*Phloeotribus liminaris*) is known. Infested trees should be taken up and burned. It is apparently increasing in number in the State of New York.

[See page 351 of this Report.]

The Grapevine Flea-Beetle. (Popular Gardening, for June, 1890, v, p. 198, c. 2—5 cm.)

The best methods of dealing with this insect [*Haltica chalybea*] are given. A hemipterous insect [*Podisus* sp.] has been detected preying upon it at Penn Yan, N. Y.

[See page 353 of this Report.]

A New Enemy of the Currant Worm. (Popular Gardening, for June, 1890, v, p. 198, c. 2—4 cm.)

One of the large plant-bugs, *Podisus cynicus*, has been taken at Jamestown, N. Y., feeding upon and destroying many currant worms.

[See 356 page of this Report.]

Seventeen-year Locusts make their appearance. (Albany Morning Express, for June 13, 1890, p. 2, c. 5—14 cm.)

Capture of examples of *Cicada septendecim* reported at Tivoli, N. Y. The only brood to which they can be referred is that due on the Hudson river in 1894. But this insect is not known ever to have anticipated its

regular time of appearance by more than one year. They could not have been belated individuals of the 1889 brood (one of the six occurring in New York), for that is not found on the Hudson river.

In connection with the above, is given a report of their appearance at Galway [Saratoga Co.], N. Y.

A Grain Weevil Distributed. (Country Gentleman, for June 19, 1890, lv, p. 489, c. 1 — 16 cm.)

A sample of seed corn, badly infested with *Calandra oryzae* Linn., is received from Cocksackie, N. Y. The infested corn had been purchased of a New York firm. Its sale, by a respectable firm, was highly culpable, as its condition could and should have been known. It should have been consigned to the mill for feeding purposes, instead of distributing the pest to localities free from it.

Sheep Scab. (Country Gentleman, for June 19, 1890, lv, p. 493, c. 2 — 12 cm.)

Replying to inquiries: Sheep may become infested from a pasture where scabby sheep had run the year before. The remarkable vitality of the sheep-scab *Psoroptes equi*, is shown in an account of its living for two years between plates of glass. Horses are also liable to the infection from an infested pasture. How to disinfect barns from the scab insect.

[The Grain Aphis.] (New England Homestead, for June 21, 1890, xxiv, p. 216, c. 6 — 5 cm.)

The grain aphid is quite prevalent in rye fields in New York and New Jersey. An apparent blight in oats is believed to be caused by the same insect [subsequently ascertained to be associated in every specimen examined, with bacterial presence (*Jour. Mycol.*, vi, 1890, p. 72)]. For arresting the injuries of the aphid we must depend, at present, upon parasitic attacks. How the parasite attacks it.

[Insects Killed by Electric Lights.] (Albany Evening Journal, for June 26, 1890, p. 5 — 9 cm.)

Estimate from a count, in part, of the contents of an arc globe, in Albany, of the number of insects killed by one light in a single night (100,000), and what the insects were.

Rose Leaf-Hopper and Rose-Slug. (Country Gentleman, for July 3, 1890, lv, p. 538, c. 1 — 22 cm.)

Inquiry from Abington, Mass., of insects destroying the foliage of rose bushes and blasting the buds, is replied to, in identifying the "*Tettigonia rosæ*" of Dr. Harris (belonging to *Anomia* and not identical with the *rosæ* of Europe), and the rose-slug, *Selandria* [*Monostegia*] *rosæ* Harris. The features of these insects and their operations are described and remedies given.

Sweet Potato Beetles. (Country Gentleman, for July 3, 1890, lv, p. 538, c. 1, 2—10 cm.)

The beetles sent from Red Bank, N. J., as destructive to sweet potato vines, are *Cassida nigripes* and *Coptocycla aurichalcea*. They feed also on the morning-glory; their peculiar larval appearance with their excremental covering noticed. They are seldom so abundant as to necessitate the use of insecticides.

A New Bug. [A Destructive Apple-tree Insect.] (New England Homestead, for July 5, 1890, xxiv, p. 232, c. 4—13 cm.)

A caterpillar boring into the pith of the new wood of apple trees at Watertown, N. Y., and committing serious injury, is identified as the eye-spotted bud-moth, *Tmetocera ocellana*. It is briefly described, food-plants given; its feeding habits and injuries; its increase in Eastern United States; many reports of it the present year; when the moths appear, and a second brood. Spray with arsenites to kill it, and when.

The [Corn] Cut Worm. (Country Gentleman, for July 24, 1890, lv, p. 590, c. 1, 2—12 cm.)

A grub reported from Arcola, Ill., and boring into early corn and eating the kernels—each ear containing one or more—is the boll-worm or corn-worm of the Southern States, *Heliothis armiger*. Attracting the moths to plates of vinegar and molasses when they are abundant.

See Country Gentleman, xlvi. 1881, p. 759, or 1st Rept. Ins. N. Y., 1882, pp. 116-126.

Locust-Tree Borer. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 1—6 cm.)

Preventives of *Cyllene robiniae* attack, are washing the trunk of the locust with soap solution and carbolic acid mixed, and cutting out the young larvæ. Remedy, cutting down and burning badly infested trees.

Syrphus Fly. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 3—4 cm.)

The rat-tailed larva of a Syrphid fly, found in a cow-stable at Schoharie, N. Y., may be a species of *Eristalis*.

[From other examples subsequently sent and reared, it proved to be *Eristalis tenax* (Linn.)]

Elm-Tree Beetle. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 3, 4—10 cm.)

In answer to request from Nyack, N. Y., for a remedy for this beetle, directions are given for spraying the foliage, and recommendation made of killing the larvæ when they descend the tree trunks for pupation.

[Collections in Keene Valley, N. Y.] (Albany Evening Journal, for August 16, 1890, p. 6 — 6 cm.)

Brief notice of collections made in the Adirondacks by the State Entomologist, during July and August, and of a reported disease of pine-trees near Keene Valley.

Insect Parasites. (Country Gentleman, for August 21, 1890, lv, p. 662, c. 1 — 5 cm.)

The green grapevine Sphinx received from Geneva, N. Y., has been parasitized by *Apanteles congregatus* (Say), the cocoons and matured insects of which were in the box when received. For particulars of this common attack, see Fifth Report Ins. N. Y., 1889, p. [35] 177.

The Carpet Beetle. (Country Gentleman, for August 21, 1890, lv, p. 662, c. 3 — 4 cm.)

Insects from Dorchester, Mass., the neighborhood of which is reported "full of them," are the *Anthrenus scrophulariæ*. Remedies: use of kerosene or benzine; leave carpets unnailed and make frequent search beneath the border for the larvæ.

[Severe Bite of a Horse-fly.] (Albany Evening Journal, for August 28, 1890, p. 8, c. 3 — 4 cm.)

A horse before a wagon, standing by the sidewalk in Central avenue, pranced and threw himself to the ground, from the pain of a bite of a horse-fly [*Tabanus atrata*] fastened to him. The fly, which was secured, was unusually large, measuring two and one-fourth inches in expanse of wings.

A Curious Jumping Gall. (Popular Science News, for August, 1890, xxiv, p. 119, c. 1-3 — 47 cm.)

To an inquiry from Weybridge, England, of a curious insect on a bough of May bloom, resembling a bud, answer is made that it is probably the bedeguar of the hawthorn, *Cecidomyia crataegi* Winnertz: note from Dr. Riley thereon. Other jumping galls are mentioned.

[See pages 308-310 of this Report.]

[The Midge or Punky of the Adirondacks.] (Albany Evening Journal, for September 5, 1890, p. 5, c. 2 — 9 cm.)

In reply to inquiry made of the name of the above insect, it is stated: "Midge" or "gnat" is too general a name for it; punky would be preferable, and it will be given in the forthcoming Century Dictionary. "The little gray gnat" would be a good designation for it. It belongs to the genus *Ceratopogon*, but is without a specific name. There may be different species of it, as there are of the Adirondack black-fly.

[Mites Infesting a Water-trough.] (Albany Evening Journal, for September 5, 1890, p. 5, c. 2 — 16 cm.)

Mites occurring at Schodack Center, N. Y., in large numbers in a barn-yard water-trough, are a species of *Bryobia*, and probably *B. pratensis*. [See pages 322, 323 of this Report.]

Spittle Insects. (Country Gentleman, for September 25, 1890, lv, p. 759, c. 4 — 22 cm.)

In answer to inquiries from Northampton, Mass., "spittle insects" and the spittle-like mass in which the larva lives are characterized. The manner in which the spittle is produced is given in a translation from DeGeer's *Mémoires des Insectes*.

A Mite Parasitic on the House Fly. (Albany Evening Journal, for October 1, 1890, p. 6, c. 2.)

Some flies from Gouverneur, N. Y., sent for examination, were infested with a red mite which is identified with *Trombidium muscarum* (Riley). Many of the flies in that place were similarly attacked. Another mite infesting flies, noticed.

The Pear-leaf Blister. (Country Gentleman, for October 2, 1890, lv, p. 781, c. 3, 4 — 35 cm.)

Pear leaves from Charlotte, N. Y., show a severe attack of this blister, which is described as caused by the gall mite, *Phytoptus pyri*. Remarks on the galls produced by the *Phytoptidæ*, and features of the mites. Remedies are to be found in sulphur applications, burning all the infested leaves, and heavily pruning the trees in winter.

Weevils in Rye. (Country Gentleman, for October 2, 1890, lv, p. 782, c. 2 — 6 cm.)

The weevil reported as infesting last year's rye in Denville, N. J., is probably *Calandra granaria*. It may be killed by placing an open vessel of bisulphide of carbon upon the grain in a tightly covered bin. Quantity of the liquid to be used.

Report of the State Entomologist to the Regents of the University of the State of New York, for the Year 1889. (Forty-third Report of the New York State Museum of Natural History for the Year 1889, pp. 99-206, figs. 1-25.) Separate: Sixth Report on the Injurious and other Insects of the State of New York [October 2], 1890, pp. 110, figs. 25.

The contents are: INTRODUCTORY. NOTICES OF VARIOUS INSECTS: *Eumenes fraternus* Say—The Fraternal Potter-Wasp. *Hypoderma bovis* (DeGeer)—The Ox Warble-Fly. *Drosophila* sp.—A Flour-paste

Fly. *Adalia bipunctata* (Linn.)—The Two-spotted Lady-Bird. *Dermestes lardarius* Linn.—The Bacon Beetle. *Agrilus ruficollis* (Fabr.)—The Raspberry Gouty-gall Beetle. *Coptocycla aurichalcea* (Fabr.)—The Golden Tortoise Beetle. *Coptocycla clavata* (Fabr.)—The Clubbed Tortoise Beetle. *Bruchus scutellaris* Fabr.—A Pea Weevil. *Hymenorus obscurus* (Say)—A Bark Beetle. *Meloidae angusticollis* Say—The Oil Beetle. *Epicauta vittata* (Fabr.)—The Striped Blister Beetle. *Epicauta cincta* (Forst.)—The Margined Blister Beetle. *Epicauta pennsylvanica* (DeGeer)—The Black Blister Beetle. *Pomphopoea Sayi* LeConte—Say's Blister Beetle. *Podisus spinosus* (Dallas)—The Spined Soldier Beetle. *Prionidus eristatus* (Linn.)—The Nine-pronged Wheel-bug. *Pulvinaria innumerabilis* (Rath.)—The Maple-tree Scale-insect. *Aphis brassicae* Linn.—The Cabbage Aphs. *Gryllotalpa borealis* Burm. The Mole Cricket. *Melanoplus femur-rubrum* (DeGeer)—The Red-legged Grasshopper. Some Apple Tree Insects. NOTICES OF ARACHNIDA. *Ixodes bovis* Riley—The Cattle Tick. *Bryobia pratensis* Garman. Infesting a Dwelling-house. APPENDIX: (A.) LISTS OF PUBLICATIONS OF THE ENTOMOLOGIST. (B.) CONTRIBUTIONS TO THE DEPARTMENT. INDEX.

Snails — — Slugs. (Country Gentleman, for October 16, 1890, lv, p. 819, c. 2—8 cm.)

A non-poisonous remedy is needed for injury by snails to a mushroom bed. Slugs (naked snails), that are so destructive to gardens in England, are there killed by sprinkling them with lime water. Nitrate of soda is also used. These would probably not affect the mushrooms injuriously. Salt will kill slugs in the ground.

[See C.—G., p. 879, for Mr. Falconer's method of trapping with pieces of dry rotten boards.]

Diseased Austrian Pines. (Country Gentleman, for October 16, 1890, lv, p. 820, c. 2, 3—42 cm.)

Twigs of Austrian and California pines are sent from Matteawan and Moriches, N. Y., for explanation of their unhealthy condition. Scales of *Chionaspis pinifoliae* (Fitch), a few black thrips, and some mites are present, but could not have caused the injury. It is probably owing to some unknown atmospheric or soil condition. Fertilizing to stimulate growth is recommended. A new disease, apparently, of the white pine, known locally as "ring-rot," is referred to. Abundance of the pine *Chionaspis* in Washington Park, Albany.

[In the *Eighth Report on the Insects of New York*, in MS.]

A Manual of Injurious Insects. (Country Gentleman, for October 16, 1890, lv, p. 822-3, c. 4-1—32 cm.)

Notice of a new edition of Miss E. A. Ormerod's Manual. Past labors and publications of the author in Economic Entomology: the new features in this edition: a volume which should be regarded as indispensable to all English agriculturists. Compared with Curtis' Farm Insects.

A Guest to be Welcomed in our Homes. (Amsterdam [N. Y.] Daily Democrat, for November 1, 1890, p. 2, c. 5.)

A worm-like creature reported, from Amsterdam, N. Y., as having eaten numerous holes in a felt lambrequin, is the larva of *Scenopinus fenestralis* (Linn.), which does not injure woolens or other fabrics, but feeds only, so far as known, on the larvæ and pupæ of the clothes-moth. Its adaptation to the purpose is pointed out, and its value as a clothes-moth destroyer stated.

Bean Weevil. (Country Gentleman, for November 13, 1890, lv, p. 898, c. 3, 4 — 12 cm.)

The cause and cure for weevil in beans is asked for, from Morgan county, Tenn. The life-history of *Bruchus obsoletus* is given, together with the fact that it is capable of breeding in old and dried beans. The remedy for it is exposing the infested beans to the vapor of bisulphide of carbon.

The Larch Saw-Fly. (Country Gentleman, for November 13, 1890, lv, p. 905, c. 4 — 16 cm.)

The ravages of *Nematus Erichsonii* Hartig, on Prince Edwards' Island, Canada, is given by a correspondent, who asks for means of arrest, if any. There is no remedy for it when large areas of the larch are attacked. The trees should be felled at once and promptly converted to use. Isolated trees may be protected by arsenical spraying.

[In *Eighth Report on the Insects of New York*, in MS.]

Bot-Fly of the Hare. (Country Gentleman, for November 13, 1890, lv, p. 905-6, cols. 4, 1 — 16 cm.)

A large brown grub found crawling on a bare patch of the skin of a hare shot in Gordonsville, Va., is probably from its mode of occurrence and an outline figure given, that of *Cuterabra cuniculi* (Fabr.) Habits of the *Æstridæ*; reference to *Cuterabra emasculator* Fitch, and description of the imago of *C. cuniculi* as given by Macquart.

Insects Infesting Maple Trees. (New England Homestead, for November 15, 1890, xxiv, c. 4 — 4 cm.)

Insects living on the outer bark of maples, are too imperfectly described to permit of identification. They may be some species of plant-louse, and if so, spraying with kerosene emulsion or pyrethrum water would kill them.

[From additional information received, the insects were probably *Psyllidæ*.]

The Striped Cucumber Beetle. (Country Gentleman, for November 20, 1890, lv, p. 925-6, c. 4-1 — 30 cm.)

Inquiry from Hess Cross Road Station, N. Y., for the best remedy for this garden pest, *Diabrotica vittata* (Fabr.), is replied to, by citing

Prof. Weed's experiments with various substances as remedies and preventives, of which, excluding the insect from the plants, in manner stated, alone proved effective. But these experiments do not show that other repellants may not be found which will prove satisfactory. Dusting with ground bone has been reported successful, as also beans planted with the cucumbers or melons, as described.

The Woolly-Bear Caterpillar — *Pyrrharcia Isabella*. (Country Gentleman, for November 27, 1890, lv, p. 941, c. 2 — 34 cm.)

The insect is identified from Moreton Farm, N. Y.; the habits of the caterpillar are given, as also its description, mode of hibernation, transformations, its feeding habits, and reference to its natural enemies. The moth is also described.

[See pages 225-228 of this Report.]

Apple-Leaf *Bucculatrix*. (Country Gentleman, for December 4, 1890, lv, p. 962, c. 3 — 8 cm.)

Small white cocoons on apple-twigs from Ransomville, N. Y., are those of *Bucculatrix pomifoliella*. Reference to former notices of it in the C. G., and in 1st Rept. Ins. N. Y., 1883. It is rapidly increasing in New York, and should be promptly met by arsenical spraying.

A Mite Infesting Dwellings. (Ohio Farmer, for April 13, 1889, p. 274 — 42 cm.)*

To inquiries from Napoleon, O., and Bloomingdale, Mich., of a mite infesting dwellings, reply is made that it is probably a species of *Bryobia*; its occurrence elsewhere noticed; habits of the mites; why they enter dwelling-houses; remedies.

[Published, with additions in *Sixth Report on the Insects of New York*, 1890, pp. 62-65; pp. 158-161 of 43d St. Mus. Rept.]

PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1878 AND 1879

The Hessian Fly. (Country Gentleman, for January 24, 1878, xliii, p. 55, cols. 3, 4 — 24 cm.)

Gives a general account of *Cecidomyia destructor* Say, its history, appearance, its life-history, remedies, etc.

An Aquatic Worm. (Country Gentleman, for January 31, 1878, xliii, p. 72, c. 3 — 9 cm.)

"Animalculæ" sent from a well in Winsted, Conn., which could not be killed by lime or salt introduced, can not be identified. They bear a general resemblance to a leech in their motions when gliding over the bottom of the jar: when swimming freely, the anterior portion is shortened and extended laterally to a greater diameter than the connecting part of the body.

* Omitted from its proper place, in Report for 1889.

Grain Aphis. (Country Gentleman, for April 11, 1878, xliii, p. 232, c. 2 — 5 cm.)

The common grain aphis, *Aphis* [*Siphonophora*] *avenæ*, is identified from Bellbuckle, Tenn. It has not been an injurious species for late years.

Insect for Name. (Country Gentleman, for April 18, 1878, xliii, p. 248, c. 2 — 7 cm.)

A piece of grapevine from Keswick Station, Va., containing supposed "grape-lice," has on it the flat, oval eggs, in two rows, of *Phylloptera* [*Amblycomorpha*] *oblongifolia*. Plants on which found.

Insects for Name. (Country Gentleman, for April 25, 1878, xliii, p. 264, c. 2 — 7 cm.)

Beetles plowed up in hundreds from about three inches below the surface, on a farm in the suburbs of Albany, are the common June-bug, *Lachnosterna fusca* Frohl., and *Phyllophaga pilosicollis* Knoch [is *Lachnosterna tristis* (Fabr.)].

The Raspberry Cane-Borer. (Country Gentleman, for May 23, 1878, xliii, p. 328, c. 1 — 8 cm.)

The girdling of raspberry canes at Great Bend, Pa., is referred to *Obera tripunctata* (Fabr.) [*bimaculata* Oliv.], the operations of which are detailed.

Two Beetles. (Country Gentleman, for May 30, 1878, xliii, p. 344, c. 2 — 9 cm.)

Chrysomela trimaculata (Fabr.) [*Doryphora clivicollis* Kirby], is characterized; it feeds on milk-weed, and is not regarded as injurious. *Coptocycla guttata* (Oliv.) is briefly described, its beauty referred to, as also its occasional injuries to potato leaves.

Insects for Name. (Country Gentleman, for June 13, 1878, xliii, p. 376, c. 2 — 12 cm.)

Bibio albipennis, a harmless insect; *Dermestes lardarius*, its injuries to various animal substances; *Aphis* [*Siphonophora*] *avenæ*, hundreds occurring on heads of wheat at Edgewood, Md.; an aphis on grapevines, undetermined.

The Peach-twig Moth. (Country Gentleman, for June 27, 1878, xliii, p. 407, cols. 1-3, 44 cm.)

Insects received from Annapolis, Md., as destructive to the terminal branches of peach trees, are identified as *Anarsia lineatella* Zeller. Its synonymy is given, also Mr. Glover's account of the larva and its operations; Professor Comstock's observations upon it; Mr. Saunders' statement of its attack upon strawberry roots, and a parasite destroying it. [Extended in *First Report on the Insects of New York*, pp. 151-156.]

A Grapevine Coccus. (Country Gentleman, for July 4, 1878, xliii, p. 423, c. 3, 4—19 cm.)

A piece of grapevine from Cleveland, O., is covered with the scales of a Coccus, of which no description is found. The scale, in two forms and sizes, is described, together with the eggs beneath them. Under one scale were 1,054 eggs. Remedies for this and other *Coccidæ* are given.

Insects in Illinois. (Country Gentleman, for July 4, 1878, xliii, p. 425, c. 2, 3—15 cm.)

Insects sent from Champaign Co., Ill., as *Coccus hesperidum*, and occurring on soft maple, osage orange and black walnut (estimated, p. 421, c. 1, at more than 100,000 on each tree), are identified as *Lecanium acericola*, figured in *American Naturalist*, i, p. 14, and in Packard's Guide, p. 530. The twigs received are swarming with the active, newly-hatched lice; the scales are described, with their projecting cottony masses. It will probably not continue to be as abundant in future years. See notice of the same insect in issue of July 25 [proves to be *Pulvinaria innumerabilis* Rathvon].

Apple-Bark and Pear-Blight Beetles. (Country Gentleman, for July 18, 1878, xliii, p. 455, c. 1, 2—36 cm.)

Xyleborus pyri (Peck) [*dispar* Fabr.] and *Crypturgus* (*Monarthrum*) *mali* (Fitch) are found associated with pear-blight by a gentleman in Bradford county, Pa., supposed by him to be the cause of the blight. They are described with notice of their injuries, preventive measures, and their distribution.

The Cockscomb Elm-Gall. (Country Gentleman, for July 18, 1878, xliii, p. 455, c. 2—16 cm.)

This gall, of which inquiry is made from Staunton, Va., occurs on the *Ulmus Americana*, and the insect producing it is the *Bryoscripta ulmi-cola* of Fitch, subsequently removed to the genus *Thelaxes* by Walsh, and to *Glyphina* and *Colopha* by later writers. No remedy is known against the attack of this insect.

[See *Rept. St. Entomol. to Regents Univ. S. N. Y.* for 1886 ("Third Report"), pp. 126-128.]

An Apple Tree Insect. (Country Gentleman, for July 25, 1878, xliii, p. 471, c. 1—11 cm.)

Larvæ in crevices of a section of a limb—not in a burrow—varying in length from one-eighth to one-fourth of an inch, and apparently hymenopterous, can not be identified. They may be of parasitic origin.

The Maple Bark Scale Insect—*Lecanium aceriscorticis*. (Country Gentleman, for July 25, 1878, xliii, p. 471, c. 1, 2—34 cm.)

Dr. Fitch's account of the operations of this insect upon maples in Albany, its naming, and remedies suggested for it—for a long time over-

looked—is republished. Some remarks on the synonymy of the species are appended. [It proves to be *Pulvinaria innumerabilis*.]

[Preface and notes to the Genera of the Hesperidæ of the European faunal-Region, by Dr. Speyer.] (Canadian Entomologist, for July, August and September, 1878, x, pp. 121, 123, 124, 126, 146, 151, 163, 169.)

Introduction to above paper, p. 121, and notes, as follows: *Systasia* substituted for *Lintneria*, 122; the frenulum, 123; the tibial epyphysis, 124; on *Thymelicus*, 151; *Catodaulis* for *Daimia*, 163; tibial tufts on *Nisoniades*, 169.

Phylloxera. (Country Gentleman, for August 1, 1878, xliii, p. 488, c. 2—7 cm.)

Leaves from Milburn, N. J., are covered with the galls of *Phylloxera vastatrix*. The two forms in which it occurs on the leaves and roots.

Burrowing Beetle—*Cebrio Bicolor*. (Country Gentleman, for August 8, 1878, xliii, p. 507, c. 3, 4—19 cm.)

A beetle injurious to grass plats in Nashville, Tenn., by burrowing beneath the surface and throwing up little mounds of earth when it rains, is identified as *Cebrio bicolor*. The distribution of the family, habits of the species in burrowing and coupling, and remedies for their attack, are given.

[See *Report to the Regents for 1886*—"3d Report of the State Entomologist," p. 100.]

An Ugly Bee-Slayer. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 1, 2—31 cm.)

Method employed by *Phymata erosa* in capturing butterflies, bees, etc.; appearance and habits of the insect; feeding upon plant-lice; notices of it by writers.

[See *Report to the Regents for 1886*—"Third Report of the State Entomologist," pp. 107-110.]

A Squash-Vine Borer. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 1, 2—31 cm.)

Squash vines in Baltimore, Md., destroyed by the larvæ of *Melittia cucurbitæ* (Harris); life-history of the insect; description of the moth; pupation; means of protection from attack.

Phylloxera. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 3—4 cm.)

Galls on grape leaves, from Louisville, Ky., are identified as those of *Phylloxera vastatrix*. The galls on swamp maple, said to be similar to these, are distinct from the Phylloxera [and probably produced by a species of mite].

The New Carpet Beetle — *Anthrenus scrophulariæ*. (Entomological Contributions, No. IV, June 1878, pp. 15–23, figure. American Naturalist, for August, 1878, xii, pp. 536–544. Thirtieth Annual Report of the New York State Museum of Natural History, 1878, pp. 117–254.)

Newspaper report of an unknown carpet pest; examples taken at Schenectady; its scientific identification; earlier history; its importation; illustration of stages; larva described; transformations; beetle described; habits, habitat, and injury; its prospective harm; its operation in a house at Cold Spring, N. Y.; preventives and remedies; distribution; necessity of combatting it; other imported insect pests; not injurious to carpets in Europe.

Annual Address of the President [of the Entomological Club of the American Association for the Advancement of Science, at St. Louis, Mo., August 20, 1878]. (Canadian Entomologist, for September, 1878, x, pp. 171–176.)

Review of progress during last half century; extended catalogues of insects; present knowledge of life-histories; number of working entomologists; entomological collections; serial literature; writings of specialists; government aid in investigation and publication; biological study commended.

The Turnip Flea Beetle. (Country Gentleman, for September 12, 1878, xliii, p. 583, c. 2 — 12 cm.)

Larvæ destroying turnips at Chardon, O., of the appearance and after the manner described, are identified as those of *Haltica* (*Phyllotreta*) *striolata* Ill. [is *Phyllotreta vittata* (Fabr.)] The larva is described.

The Carpet Beetle. (Country Gentleman, for September 12, 1878, xliii, p. 583, c. 2, 3 — 18 cm.)

Extracts from an article in the August *American Naturalist* relating to distribution, its food, appearance and habits of the larva, the beetle found in flowers, its description, and remedies for the insect.

The Harlequin Cabbage-bug. (Country Gentleman, for September 26, 1878, xliii, p. 616, c. 1 — 9 cm.)

An insect destroying cabbages at Fort Union, Va., is *Murgantia histrionica* (Hahn). Its injuries in several of the States are referred to, together with preventions of its attack.

[See *First Report on the Insects of New York*, 1883, pp. 264–271.]

The Cabbage Aphis. (Country Gentleman, for November 14, 1878, xliii, p. 727, c. 1, 2 — 14 cm.)

An Aphis attacking turnips in Laceyville, O., is the *Aphis brassicæ* of Linnæus, occurring in both Europe and America. Remedies are given, as the use of lime, soap-suds, and tobacco water.

The aphis on the apple-twigg is *Aphis mali*.

Economic Entomology during the year 1877. (Thirty-seventh Annual Report of the N. Y. State Agricultural Society, 1878, pp. 37-39.) (Transactions of the N. Y. State Agricultural Society, xxxiii, 1877-1882 : 1884, pp. 17-20.)

Importance of economic investigations as shown by the operations of the U. S. Entomological Commission ; annual losses from insect injuries ; necessity of their prevention ; additions to the literature of economic entomology ; notice of the operations of *Nephotyxa* [*Pinipestis*] *Zimmermani*, in pine, and of *Cossus Centerensis* in poplars near Albany.

Contribution to the Economical Entomology of the Year 1876. (Transactions of the N. Y. State Agricultural Society, xxxii, 1872-1876 : 1878, pp. 236-243.) [A paper presented at the Annual Meeting of the State Agricultural Society, January 17, 1877.] (Country Gentleman of May 31 and June 7, 1877.)

Notices the army-worm, *Leucania unipuncta* ; the abundance of the Colorado potato-beetle, and measures for preventing its introduction into Europe ; the grape-seed fly ; the new carpet-beetle, *Anthrenus scrophulariæ* ; and the operations of an unknown potato insect tunneling potatoes.

Report on the Insects and other Animal Forms of Caledonia Creek, N. Y. (Tenth Annual Report of the New York Fishery Commission, for the year 1877 : 1878, pp. 12-36, plates 1 and 2. Also, separate, with title-page and cover, pp. 1-25, plates 1 and 2, August, 1878.)

Examination of the waters made in view of its supposed unusual abundance of animal life, in reference to the desirability of transporting its peculiar vegetation and associated insect and crustacean fauna, to other streams, as food for trout ; the animal forms found in the mosses and other vegetation. The Fishes. Reptiles. Crustaceans — the abundant *Gammarus fasciatus* Say. Insects: Coleoptera ; Diptera ; Hemiptera ; Neuroptera — Perlidæ, Ephemeridæ, Odonata, Phryganeidæ (three subfamilies noticed). Vermes. Mollusca. The following considerations are presented: Crustaceans as food for Fishes, p. 14. Insects as food for Fishes, p. 17. Mollusca as food for Fishes, p. 18. Plants as food for Fishes, p. 18. The desirability of transplanting fish-food, p. 19. The practicability of transplanting fish-food, p. 21. The propagation of fish-food, p. 22.

Description of a New Species of *Anisota*. (Canadian Entomologist, for January, 1879, xi, pp. 10-12.)

Anisota bisecta is described from an example taken by Dr. P. R. Hoy, in Racine, Wisconsin.

The Clover-seed Fly — A New Insect Pest. (American Naturalist, for March, 1879, xiii, p. 190.)

Notice of a paper read before the N. Y. State Agricultural Society in January last, in which is described a larva infesting the blossom heads of the red clover, under the name of *Cecidomyia trifolii*. It occurs in western New York, and has caused in former years the failure of the seed crop which had been ascribed to imperfect fertilization.

The Peach-Tree Borer. (Country Gentleman, for March 27, 1879, xlv, p. 199, c. 2, 3 — 26 cm.)

Application of hot water for killing the borer, and mounding around the base of the tree for preventing egg deposit, is recommended. The plum eurenlio is sometimes found in the peach. The fungus occurring on the peach twigs submitted, is *Stereum complicatum*.

The Clover-seed Fly — A New Insect Pest. (Canadian Entomologist, for March, 1879, xi, pp. 44, 45. Annual Report of the Entomological Society of Ontario, for 1879, pp. 28-30.)

Account of the discovery of the larva in heads of *Trifolium pratense*. Its description as *Cecidomyia trifolii*, previously read to the State Agricultural Society. New localities reported.

Poduridæ (Spring-Tails) in a Cistern. (Country Gentleman, for May 22, 1879, xlv, p. 327, c. 2 — 22 cm.)

Habits of the *Poduridæ* and their systematic position. The species abounding in a cistern in Clifton Heights, O., is *Lipura fimetaria* (Linn.); was probably introduced from damp shingles of a roof. An allied species, observed at Center, N. Y., in a sandy roadway, may have been *Podura aquatica*.

[See the *Second Report on the Insects of New York*, 1885, pp. 208-210.]

Entomological Contributions — No. IV. (Thirtieth Report on the New York State Museum of Natural History, 1879, pp. 117-254. Separate, in advance of the Report, with title-page, table of contents, index, and cover, June, 1878, pp. 144.)

The contents are as follows:

1. On *Mermis acuminata* Leidy.
2. The New Carpet-bug — *Anthrenus scrophulariæ* (Linn.).
3. *Isosoma vitis* Saunders — the Grape-seed Fly.
4. List of Lepidoptera, collected by W. W. Hill, in the Adirondack Region of New York.
5. Collections of Noctuidæ, at Schenectady, N. Y., in 1875.
6. On some Lepidoptera common to the United States and Patagonia.
7. On *Lycæna neglecta* Edwards.
8. Descriptions of two New Species of Californian Butterflies.
[*Lycæna Lotis* and *Pamphila Osceola*.]

9. On some Species of Nisoniades [N. Pacuvius n. sp., N. funeralis Scudd.-Burg., N. Icelus Linn., N. Brizo Boisd.-Lec., N. Martialis Scudd., N. Persius Scudd., N. Juvenalis Fabr.]
10. Transformations of Nisoniades Lucilius Linn.
11. Description of Eudamus Epigena Butler.
12. Systematic Arrangement of the European and some American Hesperidæ.
13. Notes on Notodonta dictæa (Linn.).
14. On some New Species of Cerura [C. occidentalis, C. aquilonaris, and C. candida. Also of C. borealis (Boisd.).]
15. On Caradrina fidicularia (Morr.).
16. The Larva of Homohadena badistriga Grote.
17. Descriptions of two New Species of Xylina [X. lepida and X. unimoda].
18. Notes on Cucullia lætifera Linn.
19. Notes on Catocala pretiosa Linn.
20. On a New Species of Hypocala [H. Hilli].
21. On the Identity of Homoptera lunata and H. Edusa.
22. On the Identity of two forms of Hypenidæ [Tortricodes bifidalis and T. indivisalis].
23. Descriptions of two New Species of Phalænidæ [Acidalia lacteola and Cidaria Packardata].
24. A new Locality for Brephos infans Moesch.
25. Notes of Capture of Lepidoptera in 1876, rare to the Vicinity of Albany.
26. Notes on some Lepidoptera [Grapta Satyrus Edw., Lycæna Lucia Kirby and L. pseudargiolus Boisd.-Lec., Agrotis nigricans Linn. var. maizii Fitch, Agrotis perpolita Morr., Agrotis cupida Grote, Agrotis brunneicollis Grote, Cucullia intermedia Speyer, Xylina lambda (Fabr.) var. Thaxteri Grote, Hypena humuli Fitch, Depressaria LeContella Clem., et al.].
27. On some species of Cossus [Cossus reticulatus n. sp., C. undosus n. sp., C. plagiatus Walker, C. crepera Harris, C. querciperda Fitch].

Two-Spotted Lady-Bug. (Country Gentlemen, for June 26, 1879, xlv, p. 407, c. 1, 2—15 cm.)

A beetle found abundantly in dwellings in Poughkeepsie, N. Y., and thought to be the adult of the carpet-bug, is *Coccinella bimaculata* [*Adalia bipunctata* (Linn.)]—one of our friends to be protected. Its peculiar odor referred to.

[Extended in *Sixth Report on the Insects of New York*, 1890, pp. 21-23.]

Strawberry Borers. (Country Gentleman, for June 26, 1879, xlv, p. 407, c. 2—6 cm.)

“Worms” infesting strawberry roots in great numbers, in Muncy, Pa., are probably, judging from the description sent, the larvæ of the strawberry crown-borer, *Anarsia lineatella*.

The Golden Tortoise Beetle. (Country Gentleman, for June 26, 1879, xliv, p. 407, c. 2 — 6 cm.)

Beetles found in injurious numbers on potato vines in Philadelphia, Pa., are *Cassida* [*Coptocycla*] *aurichalcea* (Fabr.). Their usual food-plants, and Paris green for killing them.

Grapevine Galls. (Country Gentleman, for June 26, 1879, xliv, p. 407, c. 2 — 5 cm.)

Galls on grapevine, from Staatsburg, N. Y., are those of *Lasioptera vitis* Osten Sacken, from which the larvæ had emerged.

[See *Fourth Report on the Insects of New York*, 1888, pp. 63-67, f. 29.]

The Army Worm — *Leucania unipuncta* Haw. (Country Gentleman, for July 3, 1879, xliv, pp. 422, 423, cols. 4, 1 — 51 cm.)

Habits of the insect; early notice of it; its natural history; parasites in the examples received; instinct shown by *Exorista militaris* (Walsh) [*Nemoreia leucaniæ* Kirkpatrick] in its oviposition; descriptions of the larvæ and moth.

The Corn Curculio — *Sphenophorus Zæ* Walsh. (Country Gentleman, for July 10, 1879, xliv, p. 439, c. 2 — 25 cm.)

Abundant and injurious at Bordentown, N. J. Its first notice; its habits, description, distribution, and injuries.

[Is *Sphenophorus sculptilis* Uhler: see *First Report on the Insects of New York*, 1882, pp. 253-263.]

The Clover-Seed Fly. (Country Gentleman, for July 17, 1879, xliv, p. 455, c. 1 — 16 cm.)

Description is given of the larva of this insect which was noticed at the meeting of the State Agricultural Society in January last, as *Cecidomyia trifolii* n. sp. The specific name selected being preoccupied, it is proposed to designate it as *C. leguminicola*.

The Grapevine Bark Louse — *Lecanium vitis* Linn. (Country Gentleman, for July 17, 1879, xliv, p. 455, c. 1, 2 — 25 cm.)

A scale-insect on the grapevine and its leaves, from Essex county, Mass., is identified as *Lecanium* (*Pulvinaria*) *vitis* of Linnæus. The scale and egg-covering, hatching, and distribution of the young are noticed. While the scales on the vine are brown, those on the leaves are green. [The insect is *Pulvinaria innumerabilis* (Rathvon)].

[See *Sixth Report on the Insects of New York*, 1890, pp. 45-51, f. 20.]

The Striped Blister Beetle. (Country Gentleman, for July 31, 1879, xliv, p. 487, cols. 1, 2 — 37 cm.)

Beetles from Prospectville, Pa., destructive to potato leaves, are *Epicaula villata* (Fabr.). Description, and some account of it and of the

Meloide and their transformations are given. Reference to literature on it.

[See *Sixth Report on the Insects of New York*, 1890, pp. 36-38, f. 16.]

Inquiries about Ants and Beetles. (Country Gentleman, for July 31, 1879, xliv, p. 487, cols. 2, 3 — 13 cm.)

Identification of *Formica Novæboracensis* Fitch [is *Camponotus herculeanus* (Linn.)], and of *Coptocycla aurichalcea* (Fabr.), with the larval features of the latter; and of *Melanotus fissilis* Say, one of the "snapping beetles," with remarks on their habits.

On Ceeidomyia leguminicola. (Canadian Entomologist, for July, 1879, xi, pp. 121-124.)

It having been learned that the name of *C. trifolii* pertains to an European species, that of *C. leguminicola* is substituted for it. Notice of the rearing of the imago, its description and its distribution.

The Stalk Borer — Gortyna Nitela Guenée. (Country Gentleman, for August 7, 1879, xliv, p. 503, cols. 2, 3 — 35 cm.)

The caterpillar is sent with inquiries from Monsey, N. Y., with account of its habits in boring potato stems and causing them to break down. In reply is given its food-plants, its description and that of the moth, life-history, and remedies.

[Extended in the *First Report on the Insects of New York*, 1882, pp. 110-116, f. 26.]

Two Carpet Bugs. (Country Gentleman, for August 7, 1879, xliv, p. 503, c. 4, 18 cm.)

Two larvæ from beneath carpets in Poughkeepsie, N. Y., are *Anthrenus scrophulariæ* (Linn.), and *Attagenus megatoma* (Fabr.) [is *A. piceus* Oliv.]. Distinguishing features of the two are given. Remarks upon the latter as a carpet pest [see *Second Report on the Insects of New York*, 1885, pp. 46-48.]

The Wheat-stem Maggot — Meromyza Americana Fitch. (Country Gentleman, for August 21, 1879, xliv, p. 535, cols. 3, 4 — 51 cm.)

Stalks of spring wheat from Scipioville, N. Y., contain the larva of this insect; its location in the stem; its description and that of the fly; literature of the species; its injuries; allied species in Europe; little is known of our *Oscinidæ*; its popular name; is difficult to control.

[Extended in the *First Report on the Insects of New York*, 1882, pp. 221-227, figs. 66, 67.]

The Carpet Beetle. (Country Gentleman, for August 21, 1879, xliv, p. 535, c. 4 — 4 cm.)

The insect identified from Poughkeepsie, N. Y., as *Anthrenus scrophulariæ*.

The Earth Worm—*Lumbricus Terrestris* Linn. (Country Gentleman, for September 4, 1879, xliv, p. 567, cols. 2, 3—20 cm.)

From eggs deposited in loose soil in July or August, the worms in their complete stage, are developed the following spring. The sexes are united in the same individual, but fertilization is a reciprocal action for which two unite. Their principal food is earth, from which they extract the animal and vegetable matter. They also feed on plants, drawing within them the tips of grass or leaves and extracting the juice. Little is known of their life-history. From their action in loosening the soil their benefits exceed their injuries.

Annual Address of the President [of the Entomological Club of the American Association for the Advancement of Science, at Saratoga, N. Y., August 26, 1879]. (Canadian Entomologist, for September, 1879, xi, pp. 163-175. Annual Report of the Entomological Society of Ontario, for 1879, pp. 11-18. American Entomologist, for January and February, 1888, iii, pp. 16-19, 30-34.)

Mainly a notice of the principal publications and investigations in Entomology during the preceding year, of which, among others, are these: Baron Osten Sacken's Catalogue of the Diptera of the U. S.; Dr. Loew's Dipterological labors; the entomological serials of the United States and Canada; special studies in the Noctuidæ, Tortricidæ, Tineidæ; local lists of species; life-history studies of W. H. Edwards; publications on the biology and in the anatomy of insects; biological collection of the Museum of Comparative Zoölogy at Cambridge, Mass., work of the U. S. Entomological Commission; studies on the pupation of butterflies; discovery of immense western beds of fossil insects.

Two Pests of the Clover Plant. (Country Gentleman, for October 2, 1879, xliv, p. 631, cols. 3, 4—32 cm.)

A correspondent from Bristol Springs, N. Y., describes an insect found in its three stages in and among the roots of clover, and its injuries to the plant; also another observed creeping from the head, resembling the wheat-midge larva. The former is identified as the clover-root borer, *Hylesinus* [*Hylastes*] *trifolii* Mull., first detected in this country the preceding year; its operations are stated. The latter has only been known and described the present year, as *Cecidomyia leguminicola* Lintn.; its present distribution is given.

Apple Tree Insect. (Country Gentleman, for October 9, 1879, xliv, p. 648, c. 1—9 cm.)

A coleopterous larva sent from Carrollton, Ky., can not be identified. It may belong to the *Carabidæ*, and if so, would not have caused the suspected injury to the tree. Its description is given.

Coccus on Peach Trees. (Country Gentleman, for October 23, 1879, xlv, p. 679, cols. 2, 3 — 10 cm.)

A peach-twigg from Chambersburgh, Pa., has on it a number of scale-insects which are not recognized. They apparently differ from the *Lecanium persicæ* Modeer, as described by Dr. Fitch. Remedies for it are given.

A Grape Insect. (Country Gentleman, for October 23, 1879, xlv, p. 679, c. 3 — 7 cm.)

A small caterpillar from Summerfield, Ill., sent as attacking and destroying the leaves of the Taylor's Bullitt grapes only, in a vineyard embracing many varieties, can not be identified. From a crushed pupa of one of the larvæ it is thought that it may be a *Depressaria*.

A Dung Beetle. (Country Gentleman, for October 30, 1879, xlv, p. 695, c. 4 — 18 cm.)

A beetle occurring in great number at Annapolis, Md., greedily eaten by ducks, and called "the young tumbler-bug," is *Aphodius inquinatus* Herbst. The beetle is described with its habits and transformations. Reference to allied species—*A. fimetarius* (Linn.) and *A. fossor* (Linn.).

[Published in 40th Rept. N. Y. State Museum Nat. Hist., 1887, pp. 102-103 = *Third Report Insects of New York*.]

The Five-Spotted Sphinx. (Country Gentleman, for October 30, 1879, xlv, p. 696, c. 1 — 7 cm.)

Sphinx quinquemaculata Haw. is identified, the larva of which—the tobacco-worm—often occurs abundantly on tomato and tobacco plants. Its transformations are given.

Apple Tree Insects. (Country Gentleman, for November 6, 1879, xlv, p. 711, c. 3, 4 — 30 cm.)

Larvæ from Carrollton, Ky., taken from beneath bark, are apparently dipterous, but can not be identified. The "flat-headed borer" reported as infesting the end of the twigs, if a *Chrysobothris*, is probably not *femorata*. Several species, judging from the range of food-plants assigned, may be confounded under the name of *femorata*.

[See *Sixth Report on the Insects of New York*, 1890, pp. 57-59.]

A Grape Insect—*Procris Americana* Boisd. (Country Gentleman, for November 6, 1879, xlv, p. 711, c. 4 — 10 cm.)

The grapevine insects noticed in the Country Gentleman of October 23d, which could not be named, are identified by Mr. E. A. Schwarz as *Procris Americana* Boisd. The larvæ are described, habits given, and the moth characterized. The larvæ can easily be destroyed when feeding in company, by hand-picking and crushing.

Coccus on Peach Trees — *Lecanium Persicæ*. (Country Gentleman, for November 6, 1879, xlv, p. 711, c. 4 — 8 cm.)

The coccus insect noticed in the Country Gentleman of October 23d, is the above-named species, as determined by Mr. E. A. Schwarz, who also sends its synonymy. How the examples received differed from Dr. Fitch's description of *L. persicæ*.

The Fitch Biological Collection of the N. Y. State Agricultural Society. (Psyche, September — December, 1879, ii, pp. 275, 276.)

The collection, arranged in six table-cases, is as follows: Case 1. Insects infesting grain and other crops; Case 2. Grass insects; Case 3. Insects of the garden; Cases 4 and 5. Insects infesting fruit-trees; Case 6. Insects injurious to men and animals. The number of specimens in these cases is about sixteen hundred. The labeling is that of Dr. Fitch, except of a few specimens subsequently added. The larger biological specimens are in wall-cases on an upper floor of the Museum. Notice of a collection placed in the State Museum, and of the Homoptera contained therein which have alone escaped destruction.

(D)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the Contributions that have been made to the Department during the year (1890):

LEPIDOPTERA.

Six hundred and two specimens of butterflies and moths, from South America and the United States: see notice on page 220. Also, one hundred and one specimens, collected at Murray Bay, Province of Quebec, Canada, viz.: Hymenoptera, 7; Lepidoptera, 52; Diptera, 3; Coleoptera, 28; Hemiptera, 3; Neuroptera, 8. From ERASTUS CORNING, Jr., Albany, N. Y.

Larvæ of *Junonia Cœnia* (Boisd.-Lec.), September 3d, and the imago therefrom, October 2d. From J. V. D. WALKER, Jamaica, N. Y.

Larva of *Thyreus Abboti* Swainson, July 15th. From J. SAGER, Naples, N. Y.

Parasitized examples of the grapevine sphinx, *Darapsa Myron* (Cramer), July 17th. From H. C. WILLIAMS, Knox, N. Y.

Parasitized examples of *Sphinx chersis* (Hübner). From Mrs. K. M. BUSICK, Wabash, Ind.

Eggs of *Orygia nova* Fitch. From Rev. T. W. Fyles, South Quebec, Canada.

Larva of *Empretia stimulea* Clemens, August 30th. From Rev. CLEMENT G. MARTIN, Greenport, N. Y.

Larvæ of *Phobetron pithecium* (Sm.-Abb.), from apricot, August 16th. From Miss H. G. MYER, Port Ewen, N. Y.

Thyridopteryx ephemeraformis (Haw.), in cases, from quince trees. From ANDERSON BRAY, Sargeantsville, N. J.

Perophora Melsheimerii Harris, feeding on oak, September 30th. From Dr. OTTO LUGGER, St. Anthony's Park, Minn.

Larvæ of *Datana perspicua* Gr.-Rob., feeding on sumach, August 23d. From H. G. DYAR, Rhinebeck, N. Y.

Larvæ of *Datana ministra* (Drury), in numerous examples, in different stages of growth. From W. C. BARRY, Rochester, N. Y.

Young larvæ of *Edemasia concinna* (Sm.-Abb.), parasitized by *Limneria fugitiva* (Say). From SAMUEL E. RUSE, Haines Falls, N. Y.

Agrotis tessellata Harris, from some cabbage cut-worms. From JEROME MABEE, New York.

Larvæ of *Heliothis armiger* Hübn., burrowing into tomatoes, and an imago therefrom August 26th. From E. J. LORD, Albany, N. Y.

Larvæ of *Tmetocera ocellana* (Schiff.) in apple-twigs, June 5th, giving the imago June 22d. From A. B. RATHBONE, Oakfield, N. Y.

Cocoons of *Bucculatrix pomifoliella* Clemens, in June, October and November. From J. W. W., Canastota, N. Y.; from WASHINGTON GARLOCK, Utica, N. Y.; from GEORGE H. ALLEN, Brockport, N. Y.; from W. T. MANN, Barkus, Niagara Co., N. Y.; from W. H. Ransom & Son, Ransomville, N. Y.

DIPTERA.

Galls in leaves of *Abies Frazeri* similar to those of *Cecidomyia leguminicola* Lintn. From Dr. ROLAND THAXTER, New Haven, Conn.

Galls of *Lasiopoda vitis* Osten Sacken, on grapevine and leaves, June 6th. From GEORGE T. POWELL, Ghent, N. Y.

Larva of *Scenopinus fenestralis* (Linn.), about half-grown, June 21st. From E. P. VAN DUZEE, Buffalo, N. Y. The same about full-grown, October 7th, from CLARENCE VALENTINE, Albany, N. Y.

Pupæ of *Eristalis tenax* (Linn.), August 11th, giving the imago September 4th-12th. From CHARLES COUCH, Schoharie, N. Y.

Eristalis tenax (Linn.)—the fly, infesting cosmos and chrysanthemums in a green-house. From WM. FALCONER, Glen Cove, N. Y.

Larva of *Cuterabra ?cunculi* Clark, from the skin of a hare, November 6th. From H. L. LEMPRIERE, Gordonsville, Va.

Chloropisca prolifica Osten Sacken, in many examples, April 10th, and the same, August 27th. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

COLEOPTERA.

Hippodamia convergens (Linn.), *Coccinella sanguinea* Linn., *Coccinella 9-notata* Hübn., *Lema trilineata* (Oliv.), *Coptocycla clavata* (Fabr.), and six other species of undetermined coleoptera, and thirty other specimens in the different orders. From Mrs. E. B. SMITH, Coeymans, N. Y.

The Australian lady-bird, *Vedalia cardinalis* M. From D. W. COQUILLET, Los Angeles, Cal.

Epilachna borealis (Fabr.) as injurious to Cucurbitaceæ, and *Diabrotica 12-punctata* (Oliv.) from dahlias and chrysanthemums, in October. From WM. FALCONER, Glen Cove, N. Y.

Attagenus piceus Oliv. From C. M. Howard, New York city.

The tumble-dung, *Canthon levis* (Drury), June 23d. From F. F. GOODWIN, Albany, N. Y.

Aphodius fimetarius (Linn.) infested with *Uropoda Americana* Riley, from a hot-bed of the Agricultural Experiment Station at Geneva, N. Y., May 6th. From G. W. CHURCHILL, Geneva, N. Y.

Disonycha triangularis (Say), from larvæ feeding on beet leaves in July. From E. S. Goff, Agricultural Experiment Station, Madison, Wis.

Halitica sp. infesting *Ampelopsis*, in September. From Dr. JAS. H. HOOSE, State Normal School, Cortland, N. Y.

Cassida nigripes Oliv., from sweet potato vines, June 23d. From W. W. STORM, Red Bank, N. J.

Bruchus obsoletus Say, from large numbers in a dwelling, March 10th. From H. T. BASSETT, Waterbury, Conn. The same species, ovipositing, Sept. 4th. From Dr. H. C. COOX, Alfred Center, N. Y.

Bruchus rufimanus Bohem. and *Xyleborus dispar* (Fabr.). From Miss ELEANOR A. ORMEROD, St. Albans, Eng.

Bruchus scutellaris Fabr., collected at Loudon, Tenn. From Dr. E. W. DORAN, Pritchett Institute, Glasgow, Mo.

Larvæ of *Balaninus caryatrypes* Boh. from chestnuts, October 18th and 22d. From BERTHOLD FERNOW, Albany, N. Y., and EDWARD W. SEWELL, Albany, N. Y.

Calandra oryze (Linn.) feeding on seed corn, June 3d. From H. VAN SLYKE, Coxsackie, N. Y.

Scolytus rugulosus (Ratz.), June 6th, from a cherry tree. From GEORGE T. POWELL, Ghent, N. Y.

HEMIPTERA.

Benacus griseus (Say), May 21st. From J. A. PAINE, Tarrytown, N. Y.

Belostoma Americanum Leidy, drawn to light, April 24th. From FRED SMITH, Albany, N. Y.

Larvæ of spittle insects ?*Ptyelus lineatus* (Linn.), from grass, July 8th. From DAVID CROWE, Summit, N. Y.

The dog-day cicada, *Cicada tibicen* (Linn.), July 15th. From T. REED WOODBRIDGE, Port Henry, N. Y.

Unknown egg-deposit in a plum-twigg of a ?Membracid, May 6th. From ANDREW S. LONG, Dey's Landing, Seneca Co., N. Y.

The grain Aphis, *Siphonophora avenæ* (Fabr.), in June. From E. VAN ALSTYNE, Kinderhook, N. Y.; from WM TOUGH, Hudson, N. Y.; from A. FORD WILLIAMS, Chatham Center, N. Y.; from FRANK N. RAEDER, Niverville, N. Y.; from JACOB W. TITUS, Glen Cove, N. Y.; from FRANKLIN DYE, Trenton, N. J.

Aleyrodes sp. in larva, pupa, and imago, on white oxalis, April 10th. From Mrs. E. B. SMITH, Coeymans, N. Y.

Mytilaspis pomorum Bouché, on lilac. From HARRISON G. DYAR, Rhinebeck, N. Y.

Diaspis rosæ (Sandberg), infesting a climbing rose bush. From Miss H. D. LEEMING, Brooklyn, N. Y.

Chionaspis pinifolia (Fitch) on the Austrian pine. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Lecanium sp.? on Magnolia. From Professor CHARLES H. PECK, Albany, N. Y.

The maple scale-insect, *Pulvinaria innumerabilis* (Rathvon), June 23d, from Mrs. H. D. CRANE, Schenectady, N. Y.; and July 8th, from Dr. CHARLES L. HOGEBOOM, Lawrence, L. I.

Thrips sp. on diseased Austrian pines. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Bird-lice — Mallophaga — from a chimney-swallow, *Chaetura pelagica* (Linn.). From Professor HARLAN H. BALLARD, Pittsfield, Mass.

Ecanthus niveus Harris; eggs in poplar twig. From W. C. BARRY, Rochester, N. Y.: the imago, from E. B. SMITH, Coeymans, N. Y.

Amblycomorpha rotundifolia Scudder — 3 examples. Larva of *Myrmeleon immaculatus* DeGeer, from beneath a carpet, June 3d. From Mrs. E. B. SMITH, Coeymans, N. Y.

Trombidium muscarum Riley, parasitic on the house-fly, September 11th. From Miss SARAH PARKER, Gouverneur, N. Y.

Julus cæruleocinctus Wood, infested with *Uropoda Americana* — from a hot-bed. From GEORGE W. CHURCHILL, Geneva, N. Y.

GENERAL INDEX.

The author's work on this Report was necessarily suspended by severe indisposition, before the slips of the index had been entirely arranged for the printer. As he will not be able to read the proof sheets of the index, or place it in the hands of any one familiar with entomological terms, he fears that a large number of errors will creep in, for such all needed forbearance is asked.

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